Airplane View Continental Oil Company's Ponca City, Okla. Refinery

> > > The consumers' demand at their filling stations for Gyro blended gasoline which is sold at a premium has caused The Pure Oil Company to enlarge their various installations employing the Gyro Process of Vapor Phase Cracking.

THE SHARPLES PROCESS
PROCESSES OF CONTACT FILTRATION
THE GYRO PROCESS
THE SAMPLITT
THE MIXITT

MAX B. MILLER & CO. INC.
501 FIFTH AVENUE
NEW YORK

Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Volume 1 JUNE, 1930 Number 10

This issue contains

	Page
The Month's High Lights in Oildom By J. L. Dwyer	19
Rotary Drilling Mud Constitutes Problem By Warren L. Baker	20
Building Rock Pressures at Seal Beach By K. C. Sclater	22
Progress in Refinery Technology By F. R. Staley	25
Manufacturing Wax-Free Lube Stocks	28
Reducing Strains on Station Manifolds By J. H. Dameron	29
Oklahoma Plant Makes Dewaxed Oils	32
Correcting Abuses of Field Machinery By W. Angus Ross	36
Lubrication in Pipe Line Stations	41
Reclamation Plant an Economical Unit	45
Some Phases of Airplane Engine Oils By E. R. Irwin	47
Airplane Views of Flooded Tank Farm	52
Soda Soap Grease Manufacture By S. J. Caplan	54
Electrically-Operated Drilling Units	56
Utilizing Waste Refinery Gases By Paul Truesdell	59
Rotary Drill Shows Improvements	65
Progress in Vapor Phase Cracking By C. R. Wagner	70
Possibilities of Anti-Knock Fuels By Earl Bartholomew	78
Drilling Conditions in the Hobbs (New Mexico) Field By Harold Vance	82
Gasoline Engine Operation and Care By H. L. Kauffman	84
Sand Trap Over Casinghead Reduces Cutting	93
Reclaiming Oil in Large Tank Bottoms By C. H. Wright	95
Pipe Line Automotive Equipment By L. A. Farmer	102
Drilling Practices in Turner Valley By G. R. Elliott	108
Model Company Field Warehouse	114
Grinding Intake and Exhaust Valves	116
Model Gasoline Plant in Konawa Field By Anson W. Dwen	118
Caustic Treatment of Distillates By L. C. Atchison	164
Twenty Years' Progress in Natural Gasoline Manufacturing By Frank P. Peterson	167
Lubrication of Air Lift Compressors	170
Testing Formations for Colorless Oils By P. C. McConnell	175
Electrical Pumping Equipment	178
Metering Oil in Pipe Line Systems By Hollis P. Porter	182
Handling High-Pressure Wells By R. H. Pence	190

REGULAR DEPARTMENTS

Pictorial Petroleum ..... **147 to 162, inclusive**

New Petroleum Equipment **120, 125, 127, 129, 130, 133, 135, 136 and 139**

Running Tour With Men in the Industry **140 and 142**

Laugh With Barney **144**

New Petroleum Patents ..... **192 and 193**

SPECIAL NOTE: Each issue of The Petroleum Engineer is copyrighted. Any republication of the matter appearing in the magazine, either wholly or in part, is not permitted except by special authorization.

THE PETROLEUM ENGINEER PUBLISHING CO.

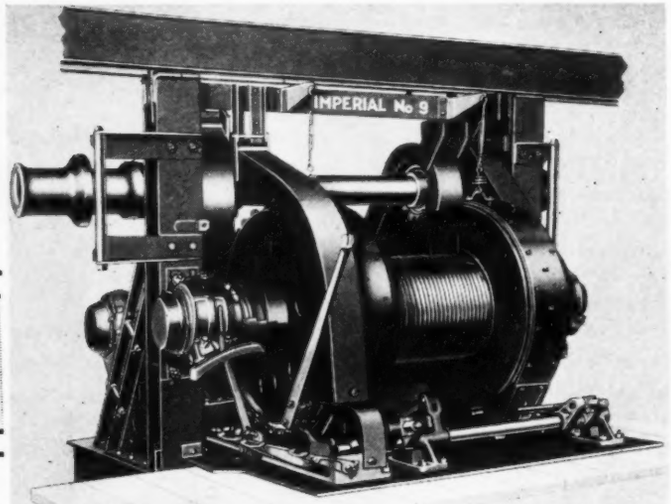
EXCHANGE BANK BUILDING TULSA, OKLAHOMA

C. MORRIS - - - - - - - *President-General Manager*
J. L. DWYER - - - - - - - - *Vice-President-Editor*
T. J. CROWLEY - - - - - - - - *Vice-President*
W. T. BRYAN - - - - - - - - *Secretary-Treasurer*
W. L. LOVE - - - - - - - - *Advertising Manager*
K. C. SCLATER - - - - *Oil and Gas Production Editor*
J. H. DAMERON - - *Oil and Gas Transportation Editor*
F. R. STALEY - - *Refining and Natural Gasoline Editor*
WARREN L. BAKER - - - - - - - *Associate Editor*

AMERICAN ROLLER BEARINGS HEAVY DUTY

THE STANDARDIZED HEAVY DUTY BEARING OF THE OIL INDUSTRY

PROGRESS in HOISTS



***The* "Oilwell" Imperial No. 9**
HOIST

The entire hoist is American self-aligning roller-bearing equipped. Bearings are Alemite-lubricated and guarded against intrusion of dirt. Bearing housings on the jack shaft and line shaft are interchangeable. Line and jack shafts are each eight inches in diameter. All shafts can be completely stripped of sprockets, clutches, drum and collars on the derrick floor.

One more step forward—
a new design — an advanced standard of construction—all for the purpose of handling heavy loads better than before. And since the basis of satisfactory operation rests on the quality, the choice continues to be . . . .

HEAVY DUTY AMERICAN

ROLLER BEARINGS

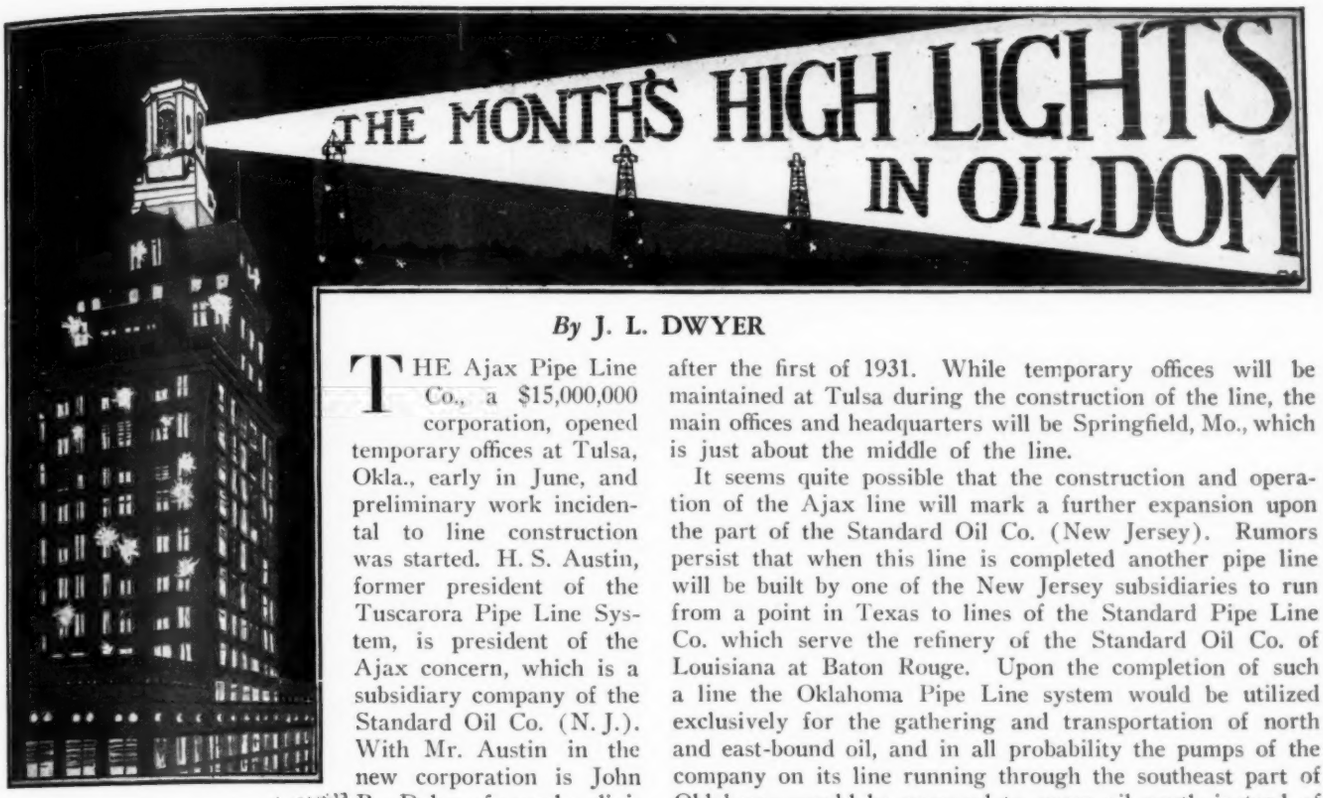
AMERICAN ROLLER BEARING COMPANY, PITTSBURGH, PA.

Frank M. Cobbledick Co., 1031 Polk St., San Francisco

Pacific Coast Representatives

Edward D. Maltby Co., 321 W. Pico St., Los Angeles

When writing AMERICAN ROLLER BEARING CO. *please mention The Petroleum Engineer*



By J. L. DWYER

THE Ajax Pipe Line Co., a $15,000,000 corporation, opened temporary offices at Tulsa, Okla., early in June, and preliminary work incidental to line construction was started. H. S. Austin, former president of the Tuscarora Pipe Line System, is president of the Ajax concern, which is a subsidiary company of the Standard Oil Co. (N. J.). With Mr. Austin in the new corporation is John R. Doles, formerly division superintendent of the Oklahoma Pipe Line Co. at Ardmore, Okla. Mr. Doles will be vice-president and general superintendent. H. N. Stevenson, formerly chief engineer of the Humble Pipe Line Co., is chief enginer of the Ajax and will have charge of the construction work.

Under a rather novel construction plan the Ajax company will build two ten-inch lines simultaneously. The system of the company will run from the Oklahoma Pipe Line Co.'s station at Glenpool, Okla., to Wood River, Ill., near St. Louis. Unless oil developments near its territory decree to the contrary, it will be a main line system, with no gathering facilities. It will take crude oil from the Oklahoma Pipe Line Co. at Glenpool and transport the crude to Wood River, which is an excellent junction point, and from which crude may be sent via pipe line in several directions. From this point oil may be transported northeast for delivery to Canadian refineries, it may be sent into the Great Lakes region, or it may be transported east to Atlantic Coast refineries.

It is expected that the line will be in operation shortly after the first of 1931. While temporary offices will be maintained at Tulsa during the construction of the line, the main offices and headquarters will be Springfield, Mo., which is just about the middle of the line.

It seems quite possible that the construction and operation of the Ajax line will mark a further expansion upon the part of the Standard Oil Co. (New Jersey). Rumors persist that when this line is completed another pipe line will be built by one of the New Jersey subsidiaries to run from a point in Texas to lines of the Standard Pipe Line Co. which serve the refinery of the Standard Oil Co. of Louisiana at Baton Rouge. Upon the completion of such a line the Oklahoma Pipe Line system would be utilized exclusively for the gathering and transportation of north and east-bound oil, and in all probability the pumps of the company on its line running through the southeast part of Oklahoma would be reversed to pump oil north instead of south.

The Continental Oil Co. is planning to build a new refinery at Denver, Colo., in order to furnish manufacturing facilities for its production in the Rocky Mountain region. The new plant will have a daily capacity of two thousand barrels and will be a skimming and cracking plant. In addition to this activity, the company is reported to have become interested in the manufacture of "dry ice," utilizing for this undertaking the product of its Fort Collins (Colo.) property.

An interesting occurrence of the month in the petroleum industry was the announcement that the Humble Oil & Refining Co. would stop taking oil from several oil regions in the state of Texas, principally the Panhandle. This was one of several unfavorable developments in the crude market.

Slight price reductions ranging from ten to fifteen cents per barrel were announced in the Pennsylvania fields this week, while many market students anticipate reductions in the price of Mid-Continent crudes unless the gasoline market improves.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending June 7, 1930.
(Figures in Barrels of 42 Gallons)

DISTRICT	Per Cent Potential Capacity Reporting	Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	3,791,000	89.4	9,069,000	8,302,000
Appalachian	91.0	571,000	70.0	1,785,000	820,000
Ind., Ill., Ky.	99.6	2,289,000	85.8	8,347,000	3,964,000
Okla., Kans., Mo.	89.8	2,052,000	70.6	4,803,000	4,656,000
Texas	90.8	4,078,000	81.4	7,631,000	10,440,000
Louisiana-Arkansas	96.8	1,161,000	63.3	2,470,000	2,083,000
Rocky Mountain	93.6	408,000	41.9	2,772,000	1,142,000
California	99.3	4,351,000	69.7	16,380,000	106,982,000
Total Wk. June 7	95.8	18,701,000	75.7	53,257,000	138,389,000
Total Wk. May 31	95.8	17,964,000	72.8	52,715,000	137,593,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.					
Texas Gulf Coast	100.0	3,098,000	84.1	6,451,000	7,517,000
Louisiana Gulf Cst.	100.0	861,000	83.4	2,053,000	1,160,000

Daily Average Production
(Figures in Barrels)

	June 7, 1930	April 19, 1930	June 8, 1929
Oklahoma	667,600	658,100	683,050
Kansas	134,600	117,050	119,100
Panhandle Texas	111,100	93,600	89,100
North Texas	81,400	79,350	83,600
West Central Texas	58,450	54,150	52,050
West Texas	302,100	313,950	366,100
East Central Texas	40,750	34,250	19,300
Southwest Texas	69,700	58,800	78,550
North Louisiana	40,750	41,750	34,900
Arkansas	56,400	57,800	70,900
Coastal Texas	184,000	185,700	125,800
Coastal Louisiana	23,050	21,650	20,900
Eastern (not including Michigan)	125,500	128,000	103,050
Michigan	10,300	11,700	13,100
Wyoming	49,550	50,700	47,400
Montana	9,200	10,450	11,700
Colorado	4,350	4,550	7,700
New Mexico	19,850	11,450	2 650
California	599,400	627,900	195,500
Total	2,588,050	2,560,900	2,724,450

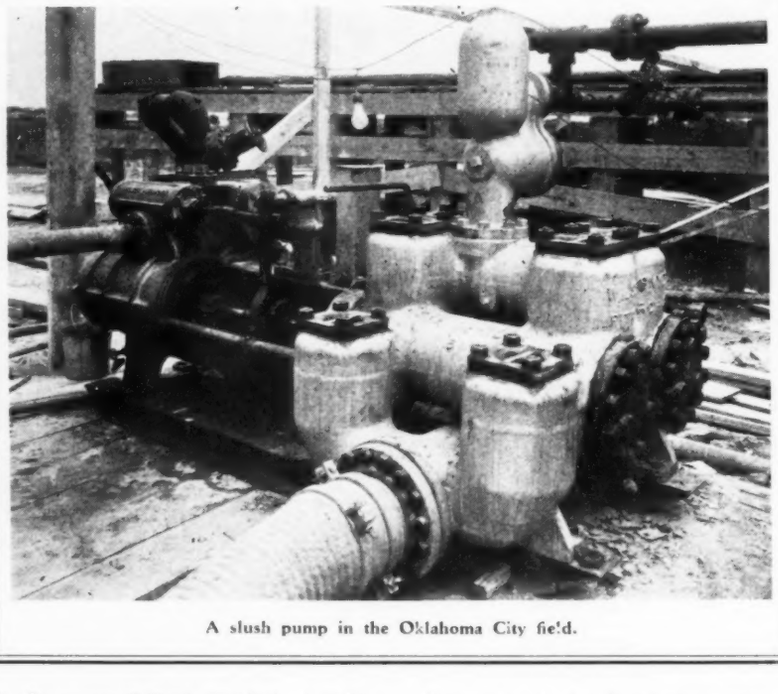
Rotary Drilling Mud Constitutes

By WARREN

THE Oklahoma City field is not a difficult drilling proposition, except in the matter of combating the extremely high pressures found there. Circulating rotary mud has been found to be the principal drilling problem because of these pressures, which often run as high as 2,000 pounds per square inch.

Drilling is done exclusively with rotary equipment, even to the drilling in of the wells. The rotary equipment is of the latest and heaviest design. The heavy equipment, general softness of the formations and little shut-down time account for the quick time made in reaching the 6,400- and 6,500-foot producing level. The average drilling time, including the cementing and setting of pipe, is from 112 to 115 days.

Ordinarily three strings of casing are used, although in several instances but two strings have been run. The surface string is run to a depth of about 200 feet and cemented to the top of the ground. The next string is set around 5,000 feet, with the last and producing string set around 6,350 feet, or just as near the producing horizon as possible.



A slush pump in the Oklahoma City field.

The method of bringing the wells in is quite interesting. When the bit has encountered the producing horizon, and after setting the last string of casing, a predetermined penetration of the formation is made. This penetration is ordinarily for a hundred feet or more. During this time is the most difficult period of drilling at Oklahoma City, because of the danger of a blow-out. To combat the danger of a blow-out, the hole is kept full of heavy rotary mud.

A master-gate is usually installed during this time, and recently it has become a general practice to install some type of equipment to safeguard against a blow-out. Upon reaching the predetermined penetration of the producing horizon the rotary pipe is withdrawn.

Then comes the period of preparing to bring the well in. Bailing is commenced and continues until gas begins to show through the mud left in the hole. The master-gate is then closed and all connections, including flow lines, Christmas tree, traps, waste gas lines and lines to the battery tanks are made. After stripping the well of all equipment possible, such as the crown block, traveling block, etc., the well is ready to bring in.

This is accomplished by merely opening the master-gate and allowing the well to blow the mud out of the hole. The bringing in of a well at Oklahoma City offers a spectacular sight. The enormous gas pressure soon commences to remove the mud. At first it rolls out over the casing head, but as the weight becomes lighter it shoots higher up the derrick. In a few minutes the mud has been blown from the hole. The flow of gas and oil is permitted to go into the air until the well has completely cleaned itself. During the time that the well is cleaning itself, mud is thrown against the derrick with such force that loud, cannon-like reports are heard, while the roar is nearly deafening at close distances.

The flow is turned into the tanks after it has cleaned itself. This is accomplished without ever going on the derrick floor. A long arm working on a sprocket shuts the master-gate, while another similar device opens the cellar-gates to the separators and tanks.

A slight amount of oil and gas is lost, but this seems to be the only means of bringing in the wells, since the great pressures, often reaching 2,300 pounds per square inch, prohibit the drilling-in under usual methods.

Because of the important part circulating mud plays in bringing the wells in, it is a major problem in the drilling operations of the field. At all times when near the producing horizons the mud is depended upon to prevent the high pressures from causing sudden blow-outs. The mud must not only be kept circulating, but be of sufficient weight to offset the pressures encountered and still be thin enough to wash the cuttings out.

Better drilling time can be made with thinner mud than generally used in the field, but in the interests of safety the general practice is to use heavy muds. When drilling in the upper part of the hole, nine-pound mud is often used, but after setting the final string of casing the average weight

Problem in Oklahoma City Field

L. BAKER

of the mud must be increased to about 12 pounds per gallon.

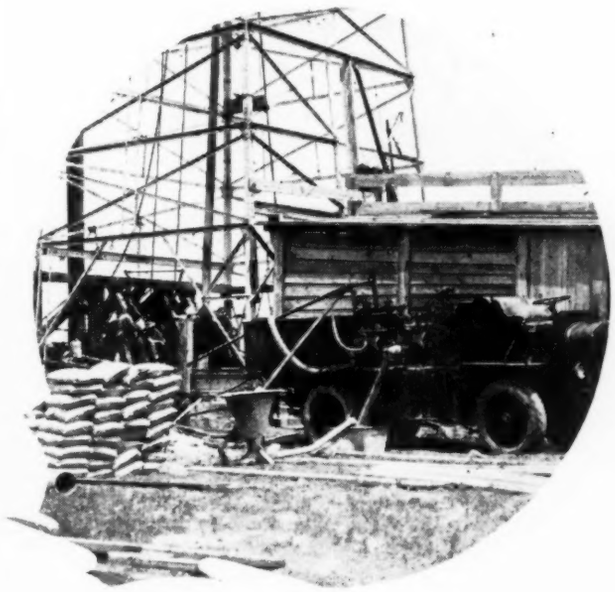
Even before setting the final string of pipe, attention must be paid to the mud condition, as there are some upper formations that in various parts of the field have mustered sufficient strength at times to give serious trouble. Consequently during the major portion of the drilling time contractors must be prepared for such an occurrence.

Several of the operating companies have made a thorough study of the mud proposition in the field. A number of these companies give strict instructions to the drilling contractors regarding the thickness and weight of the mud that should be used, and from time to time check the mud condition for themselves. Most of the contractors are very willing to follow any advice given along this rather ticklish problem. The companies, realizing the many difficulties attached to the problem, stand ready to aid the contractors should they need it.

The Indian Territory Illuminating Oil Company, for one, has made a careful check of the mud characteristics and necessities in the region. This work was done by F. D. Beardmore.

When making a diagnosis of the rotary circulating mud, its thickness, weight, viscosity, sand content and several other items must be taken into consideration. A factor in making the mud problem a more difficult proposition at Oklahoma City is that rotary cuttings from different parts of the field have shown a wide variety of characteristics. It is, therefore, hard to set up any general rules to be followed in all parts of the field. Each test is more or less of an individual problem.

After the final string of casing has been set it becomes necessary to buy mud to complete the hole, since the sand formation to be penetrated does not yield cuttings that will make mud. Consequently there is a big market for materials for making mud and making it heavier. Some of the heavy materials have been found more suited for some wells than for others, and as there is a wide difference of opinion concerning the best material, consequently a large variety of materials are used. A few contractors are shipping soil for mud making purposes from other points and mixing it in the slush pits.



Getting ready to cement a deep well.

A section of West Texas where drilling mud must be hauled a long distance.

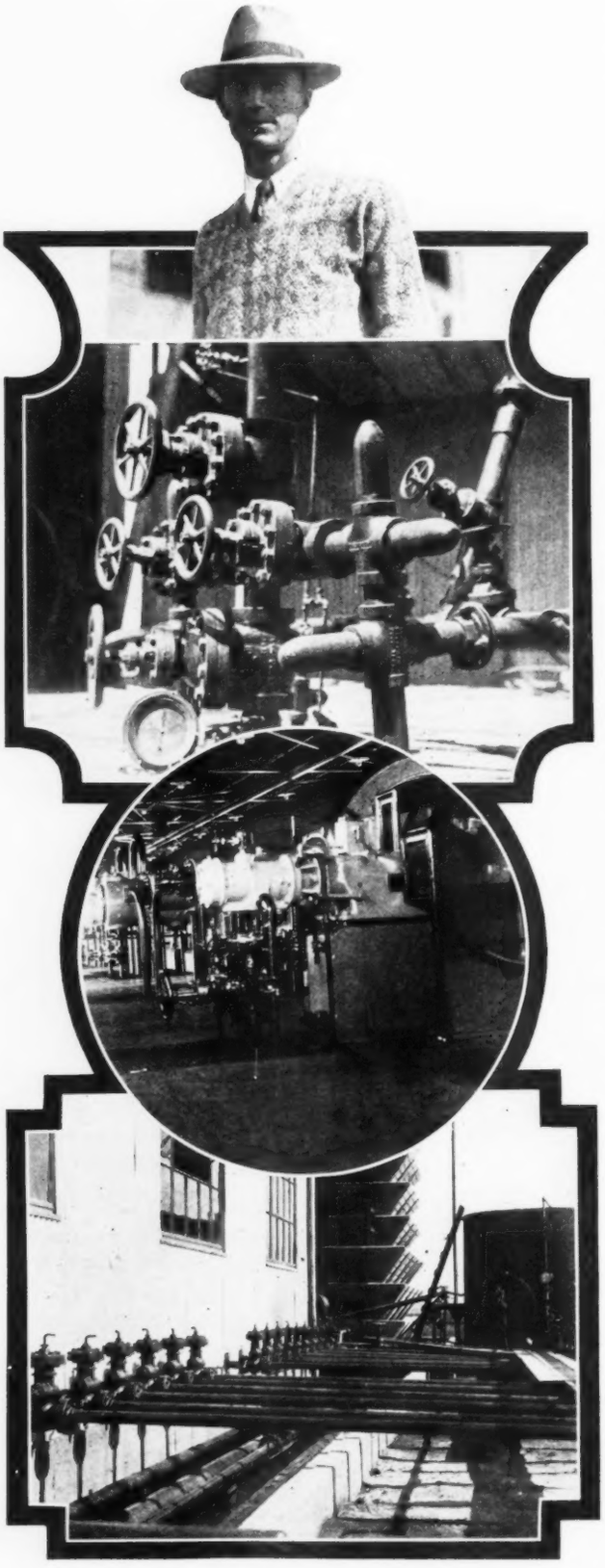
The necessity of maintaining heavy, thick mud makes each rainfall an additional annoyance to the contractors. After every heavy rain the mud must be thickened again to its proper consistency. In several parts of the field difficulty has been experienced from having the cuttings settle out of the mud, leaving it light.

The general practice in the field is for every well to have several slush ponds, usually three.

The necessity for maintaining heavy muds and the large quantities required make it necessary to equip each rig with heavy circulating slush pumps. Since the active development of the Oklahoma City field, the heaviest type of circulating mud pumps ever used in the Mid-Continent region have been employed.

Positive Results *in* Building

By K. C.



EXTREME curtailment programs under which most of the oil companies are operating today no doubt will be instrumental in bringing to notice the benefits, or detriments, to be derived by producing wells under high back pressure. It is known that many companies, in addition to curtailing production, are forcing gas back into the sand and thus are maintaining or increasing rock pressures with a view to increasing future ultimate recovery and decreasing future lifting costs. To make an evaluation of the results of closing in production takes time, patience and a close study of data and operating conditions.

The technical and field staffs of oil companies today are taking full advantage of the opportunity that present conditions in the industry offer to survey in detail their producing operations and to garner all available field information pertaining to the effects of closing-in production in the different areas in which they operate. In normal times, in a field in which there are many operators, it is seldom possible to get reliable data regarding the effect on producing wells of conserving the rock pressure in a structure, because of the wide variation in methods employed by different operators in producing their wells. Competitive conditions often are conducive to the practice of producing wells wide open, regardless of whether or not it is the best and most economical method to adopt. Local conditions, such as the underground structural factors, the initial and existing rock pressure, the number and character of producing sands, the presence or absence of water, the depth, number, and age of wells producing, the production methods employed and the division of property interests in the field, all come in for consideration. In a field where the operators are few, however, and where conservative methods and good production practice are followed, definite results are observed within a very short time after changes necessitated by curtailment are put into effect.

In the Seal Beach Field, California, the Continental Oil Company has observed positive results of this nature on its Bixby lease. Until recently, gas-lift and repressuring operations were carried on simultaneously and very successfully, in the Selover Zone, a producing horizon lying at an approximate depth of 4600-4700 feet. As it happens, the wells of the Continental Oil Company on the Bixby lease are practically the only wells producing from the Selover sand, other wells of offsetting companies having been drilled to other horizons because of either small production or edge-water encroachment. This condition favored a repressuring program for the Selover sand. An injection well was chosen, Bixby No. 24, and repressuring started about February 10, 1929. Choice of Bixby No. 24 as an injection well was based on experience gained in repressuring the Bixby sand at a prior date. It was found that with the injection well high on the structure there was less tendency to by-passing of gas in the sand, a more uniform diffusion of the gas through the sand and consequently a steadier and more sustained flow of oil to the wells down structure. Also forcing gas down structure probably is more effective in retarding edge-

Top to bottom—E. W. Webb, production foreman at Seal Beach for the Continental Oil Co. Bixby No. 25, gas-lift well, now closed in—since closing in casing pressure has been built up from 700 to 1280 pounds in few months by repressuring. Compressor in foreground used for compressing injection gas to 1500 pounds for repressuring, Continental Oil Co.'s Bixby plant, Seal Beach, Calif. Orifice fittings on gas discharge lines to gas lift wells, Continental Oil Co., Seal Beach, Calif.

Rock Pressure *at* Seal Beach

SLATER

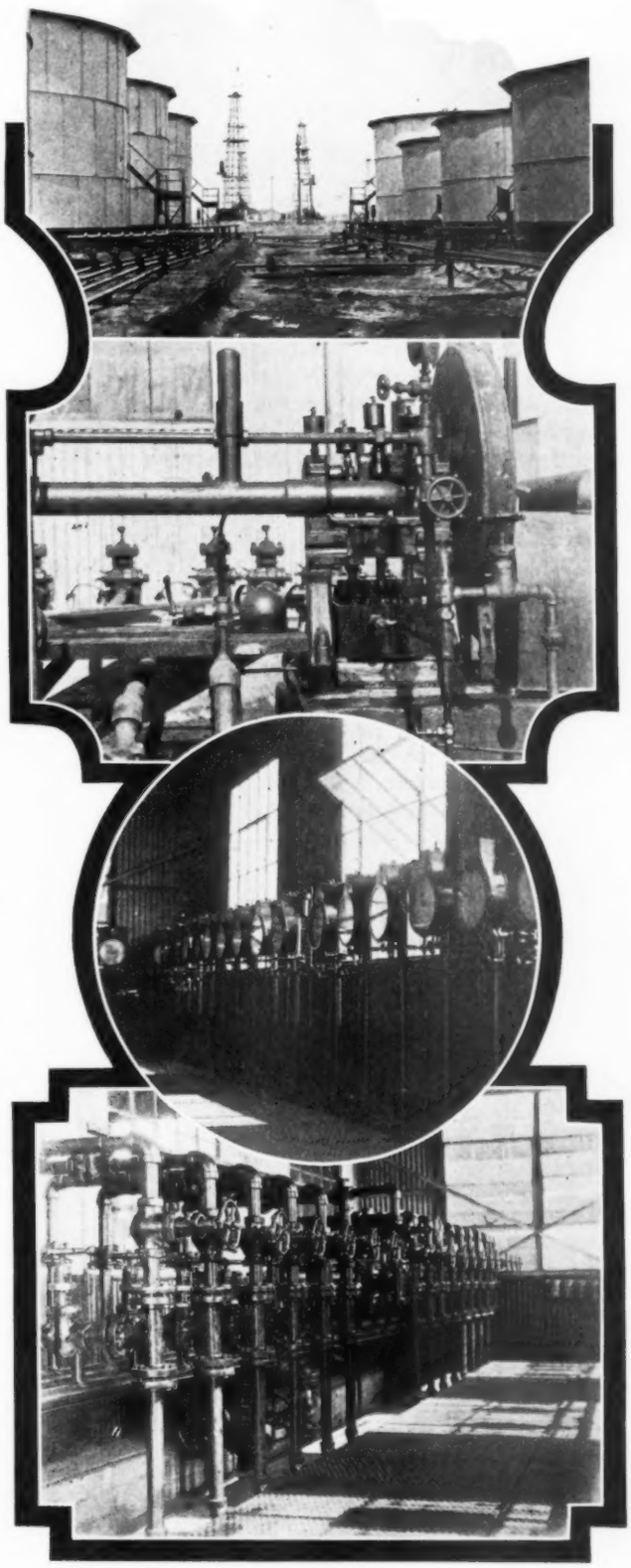
water encroachment. Bixby No. 24, the injection well, is favorably located high on the structure, being surrounded by Selover sand wells lower on structure. Up structure dissipation of the gas is prevented by a fault which forms an effective barrier to gas migration. When drilled in November, 1928, to a depth of 4825 feet, the injection well came in for an initial daily production of 1000 barrels of oil cutting 30 per cent emulsion. Owing to gas depletion, the well would not flow naturally and had to be produced by gas-lift. Penetration of the well into the Selover sand was about 200 feet. At the time it was decided to use it as a pressure well, the fluid level stood at 1350 feet from the surface from which an estimate of the approximate injection pressure necessary was made.

In preparing the well for gas injection, a packer, hung on 2½-inch upset tubing, was set at 4445 feet with 150 feet of tubing extending below the packer. The space between the tubing and casing above the packer was filled with water to the surface thus forming an effective gas seal.

When the repressuring program was decided on, most of the wells in the Selover sand had been producing for about two and a half years and had reached the gas-lift or the pumping stage. An initial injection pressure of 1160 pounds per square inch was required. As the injected gas was surplus from the gas-lift operations which were carried on simultaneously with the repressuring operations, the daily volume of injected gas varied from one to two and a half million cubic feet. Monthly volumes injected when the project was under way are shown in Table 4.

For flowing the gas-lift wells, the gas is compressed in two stages from about 25 pounds to 500 pounds, then the surplus gas for repressuring purposes is compressed another stage from about 500 to the required injection pressure. A direct connected gas engine driven compressor with 4½-inch cylinders is used for the third stage compression. For two-stage compression 5½-inch by 9½-inch by 20-inch, 170 H. P., direct connected gas-engine driven compressors are used. With the exception of some trouble which occurred at the start on account of the wet gas interfering with compressor cylinder lubrication and which has been overcome, it is a remarkable fact that no serious difficulties have been encountered in compressing the gas to the high injection pressures necessary. This would seem to indicate the possibilities of high injection pressures and also proves the feasibility of high-pressure repressuring projects. From the plant the high-pressure gas, which was not after-cooled, passed through about a quarter mile of 2-inch line to the well. In cold weather, freezing trouble occurred at the well. As the gas passed through a check valve the vapors would condense and freeze. This set up a serious hazard, as the line had to be thawed out, a dangerous job at high pressure. By installing an electric heater around the check valve, the heater, equipped with a thermostatic control and heavily insulated, freezing trouble was eliminated.

In a paper presented by A. H. Bell and E. W. Webb of the Continental Oil Company, before the local section of the



Top to bottom—Lease tanks and flow line manifolds, Continental Oil Co., Seal Beach, Calif. Triplex pump for feeding chemical into gas discharge line to gas-lift wells, Continental Oil Co., Seal Beach, Calif. Orifice meter installations on gas input lines to wells; these are in control manifold house, Continental Oil Co., Bixby plant, Seal Beach, Calif. Control manifold, gas-lift compressor plant. Note extra header for starting wells.

Gas-lift and repressuring plant, Bixby lease, Cont. Oil Co., Seal Beach, Calif.

A. I. M. E. in Los Angeles in the fall of 1929, it was pointed out that two wells, Bixby No. 12 and Bixby No. 13, after having been produced by gas-lift for about 20 months, started to flow intermittently without the aid of gas-lift after the injection of gas to the sand. Another well, Bixby No. 25, located farther up structure, also acted in a similar manner. It was also observed that two wells, completed after repressuring operations started, came in for large initial production, no doubt because of the pressure built up in the sand. One of these wells, Bixby No. 26, which was offsetting the injection well, when completed, March 27, 1929, had an initial daily production of 1000 barrels and 870,000 cubic feet gas. By July, the gas volume had doubled and the well was beaned back to 750 pounds on the tubing. It still produced 1,800,000 cubic feet of gas and was shut in July 19, 1929. When this well was closed in the production of Bixby No. 25, the next well up structure, increased 220 barrels daily. Another well, Bixby No. 14, was completed as a skimmer in the Upper Selover sand August 29, 1929, adjacent to Bixby No. 5, a Selover sand well which was abandoned some months before because of water encroachment. Other positive results following repressuring were noted. The production curve of the Selover sand wells changed from a decline to an upward trend. An increase in casing pressure sufficient to necessitate a readjustment of tubing depths occurred. Also there was an increase in the volume of formation gas produced with the oil. During the month of March, 1929, repressuring operations were suspended for five days. An immediate decline in production was observed. It was found necessary to bean back the wells in April, 1929, to bring them within pro-ration requirements. Repressuring, however, was continued. This accelerated the building up of rock pressure and it was noted the downward trend of productions was completely stopped. Later it was found necessary to shut down all Selover sand wells, this was done September 25, 1929. Wells were taken off the gas-lift and just allowed to stand. Injection of gas, however, was continued. Within about a month after taking them off the gas-lift, three wells started to flow naturally. First, Bixby No. 25 started flowing naturally, this was October 7, 1929; next Bixby No. 21, on October 15, 1929, and then Bixby No. 12 on October 30, 1929. Each was closed in completely.

Injection of gas was continued (see Table 4) until May 8, 1930. In Table 4 it will be observed how the input well pressure increased, especially after the gas-lift wells were shut down in September, 1929.

In Table 2, it will be noted that the casing pressure in Bixby No. 21 was 490 pounds when taken off the gas-lift, September 25, 1929. On May 30, 1930, the casing pressure on this well was 1320 pounds per square inch. Another well, Bixby No. 25, Table 3, also taken off the gas-lift, September 25, 1929, showed a casing pressure of 1280 pounds per square inch on May 30, 1930.

This is a striking illustration of what is being done today under conditions calling for curtailment of production. Every opportunity is taken to obtain data and analyze results following the restriction of production and the possible effect on future recovery. It also is indicative of what can be accomplished by maintaining or building up rock pressure in a reservoir and conveys a faint hint of what can be achieved when the conditions are favorable for such methods of operation.

TABLE 1

Selover sand well—Continental Oil Co.—Seal Beach
Bixby No. 12 (Produced by gas-lift[2]).

Month	Gas in M cu. ft. In	Gas in M cu. ft. Out	Formation Gas/Oil Ratio	Oil Bbls.	Casing Press.
Feb., 1929	907	962	58	963	390
Mar.	474	983	451	1058	430
Apr.	734	941	373	666	380
May	726	884	213	741	400
June	.....	.....	.....	.....	.....
July	579	885	359	857	490
Aug.	516	945	625	1032[1]	600[1]

[1] Bixby No. 26 brought in March 27th—had to shut it in July, 1929, because of excessive drainage. Note pressure and production for August.

[2] This well was taken off gas-lift September 25, 1929—flow line valve at well left open. October 30, 1929, well started to flow naturally—well closed in.

TABLE 2

Selover sand well—Continental Oil Co.—Seal Beach
Bixby No. 21 (Produced by gas-lift[2]).

Month	Gas in M cu. ft. In	Gas in M cu. ft. Out	Formation Gas/Oil Ratio	Oil Bbls.	Casing Press.
Feb., 1929[1]	.....	.....	.....	.....	.....
Mar. (from 23rd)	526	692	230	1100	425
Apr.	481	965	436	1109	430
May	476	900	476	1029	450
June	544	809	237	1111	470
July	790	889	121	861	470
Aug.	637	967	373	885	500
Sept.	807	943	145	943	490

[1] This well on natural flow until March 22nd—when Bixby No. 26 brought in stopped flowing—put on gas lift March 23, 1929.

[2] This well was taken off gas-lift September 25, 1929—flow line valve at well left open—October 15, 1929, started to flow naturally—well closed in.

TABLE 3

Selover sand well—Continental Oil Co.—Seal Beach
Bixby No. 25 (Produced by gas-lift[1]).

Month	Gas in M cu. ft. In	Gas in M cu. ft. Out	Formation Gas/Oil Ratio	Oil Bbls.	Casing Press.
Feb., 1929	804	854	53	945	410
Mar.	610	920	290	1069	470
Apr.	528	854	392	831	480
May	642	835	482	642	500
June	377	791	359	1152	650
July	184	876	.....	1147	700
Aug.	.....	1116	874	1276	730-800

[1] This well was taken off gas-lift September 25, 1929—flow line valve at well left open—October 7, 1929, started to flow naturally—well closed in.

TABLE 4

Selover sand repressuring—Continental Oil Co.—Seal Beach
Table Showing Injection Volumes and Pressure Increase on Injection Well Bixby No. 24

Month	Total Input Vol. Gas M. Cu. Ft.	Av. Input Pressure Pounds per Sq. In.
Feb., 1929	54,000	.....
Mar.	54,000	.....
Apr.	54,000	.....
May	54,319	.....
June	69,540	.....
July	60,272	1160
Aug.	56,965	1160
Sept.[1]	19,719[1]	1300
Oct.	92,485	1360
Nov.	89,994	.....
Dec.	92,965	1400
Jan., 1930	80,806	.....
Feb.	31,130	1400
Mar.	47,914	.....
Apr.	67,914	.....
May (to 8th)	15,370[2]	.....

[1] All wells taken off gas-lift September 25, 1929; overhauling compressors.

[2] Repressuring operations shut down May 8, 1930.

Recent Developments and

Progress *in* Refinery Technology

By F. R. STALEY

CONSTANT progress has been made during the past year in almost every phase of petroleum refining. Large investments were made in more efficient equipment that produces better products at lower operating costs. Most of these new units are built by engineering companies specializing in the design and construction of certain types of installations. Few oil companies would find it economical to maintain a staff of highly specialized engineers and the necessary erecting equipment to design and to install the larger and more complex refining units.

Distillation Units

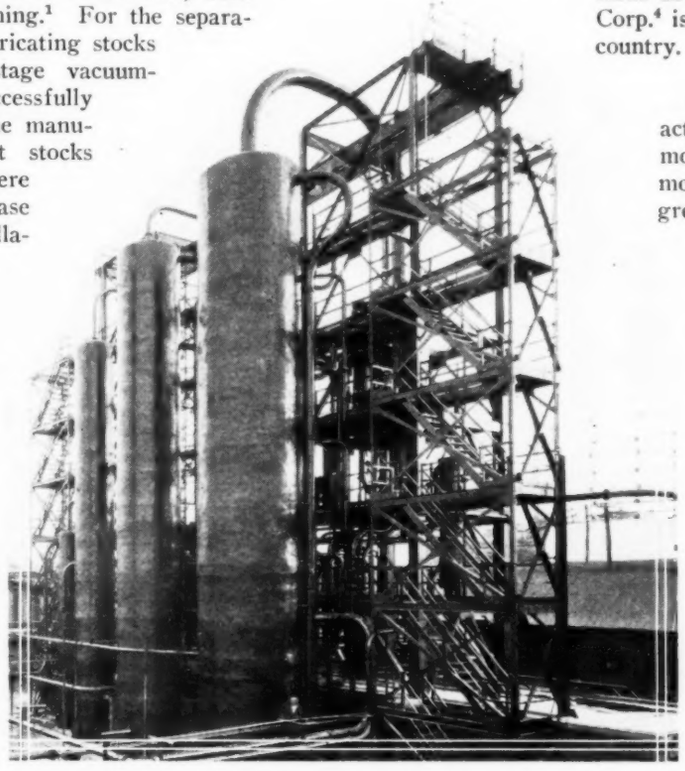
The superiority of the single flash distillation unit with the fractionating tower has been established, both for crude oil and for rerunning.[1] For the separation and fractionation of lubricating stocks from the crude the two-stage vacuum-atmospheric unit is being successfully used by many refiners in the manufacture of overhead bright stocks from mixed base crudes. There will no doubt be a large increase in the number of these installations during the coming year.

Research

Progress in the research work conducted by refiners, technical societies and government bureaus is throwing more light on the relative importance of various specifications and desirable properties of petroleum fuels and lubricants. This work has resulted in the development of new and higher quality products from petroleum. There is more co-operation than ever before between the technical departments of different oil companies through their various associations, and also between the automotive and the refining industries.

Although remarkable progress has been made along scientific lines, some doubt and confusion still exists regarding specifications and methods of testing due to the lack of sufficient or satisfactory data to establish definite conclusions. Refiners of high sulphur crudes are not certain that the added expense of reducing the sulphur content of their gasoline to meet present government specifications is justified, and whether a somewhat higher sulphur content would be harmful to the internal combustion engine. The maximum allowable gum content of gasoline has not yet been definitely established. This problem is complicated by the fact that a gasoline may contain both dissolved and potential gum or gum-forming constituents. Results obtained by the copper dish method are unreliable and unsatisfactory. The removal of the gum-forming constituents in a gasoline usually reduces its anti-knock rating. The gum problem is not a simple one, and it presents a broad field for research work. Egloff, Faragher and Morrell[2] suggested certain inhibitors to changes in knock rating of stored cracked gasoline.

As yet no standard knock-testing engine or standard fuel has been officially adopted by the industry. Due to the many variables to be considered, the problem of measuring detonation is very complicated.[3] The knock-testing apparatus developed by the Ethyl Gasoline Corp.[4] is the most widely used in this country.



Distillation units at Cities Service refinery, East Braintree, Mass.

Motor Fuel

Volatility and anti-knock characteristics are regarded as the most important properties of motor fuel. There has been a great increase in the relative quantity of anti-knock gasoline manufactured. It is estimated to be about 35 per cent of the total sales. Many more refiners have been licensed to manufacture ethyl gasoline. In building the proper volatility into a motor fuel the refiner must consider vapor lock. Dr. Brown[5] states that the tendency of a fuel to form vapor and cause trouble due to vapor lock is measured directly as its vapor pressure. To reduce the vapor pressure some refiners have installed stabilizers to remove propane and dissolve gases from their gasoline.

Many refiners have reduced the end point of their motor fuel under 400 degrees F. Several factors were responsible for this tendency. First of all, the elimination of heavy ends improves the anti-knock rating and reduces the gum-forming constituents. An efficiently fractionated product of 437 end point would not meet the 90 per cent point of 392 degrees on U. S. motor specifications. Some authorities believe that a low end point gasoline fails to give the necessary maximum power in automotive engines.

Treating

Sulphuric acid in a closed continuous system is most widely used in treating light oils. The product is then

[1] C. M. Ridgeway, The Petroleum Engineer, Dec. (1929)-April (1930).

[2] A. P. I. meeting, Dec. 5, 1929—The Petroleum Engineer, Dec., 1929.
[3] H. L. Horning, A. P. I. paper, Dec., 1929.
[4] Earl Bartholomew, The Petroleum Engineer, March, 1930.
[5] Dr. G. G. Brown, The Petroleum Engineer, May, 1930.

neutralized and sweetened, either with sodium plumbite or sodium hypochlorite. A few refiners still use the batch agitator for treating light oils. Mechanical contactors are used with considerable success in many cases.

During the past year many new vapor phase installations were made. Since the knock rating of gasoline has become so important, the problem is to remove gums without materially reducing this property. Vapor phase treating is used successfully to treat distillates from both low and high sulphur crude. It has the advantages of low cost and low treating losses.

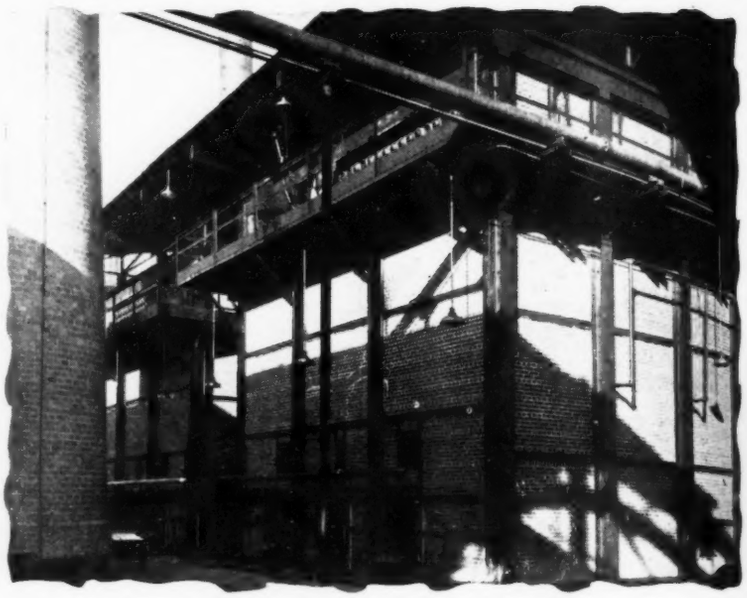
Lubricating Oils

Single flash distillation equipment and dewaxing plants were installed by many refineries to improve the quality of their lubricating oils. Closely fractionated paraffin base oils have low volatility and are, therefore, most satisfactory for fast summer driving. These oils when dewaxed have a low pour point and a viscosity temperature curve that makes them preferable for winter use. The two-stage vacuum-atmospheric distillation unit appears to be the most satisfactory for mixed base oils, since a closely fractionated lubricant of lower carbon residue and better color is produced than by the heavy acid treatment of a residual stock resulting in heavy sludge losses. The centrifuge is the most generally used method of dewaxing lubricating stocks. Selected solvents and filter aids are used to a limited extent.

Continuous methods of acid treating employing mechanical contactors are used by some refiners to treat lubricating oils, and possess many advantages over the old batch method in a cone-bottom agitator. Lower treating losses and better colors result due to the quick removal of the sludge formed. Clay neutralization, or contact filtration, is most widely used on acid-treated oils.

Refrigeration

In order to completely remove the wax from the stock it is usually chilled to minus 45 degrees in naphtha solution before centrifuging. Considerable development has been made in refrigeration engineering. A recent advancement is to entirely eliminate brine as a chilling medium. The cold dewaxed oil from the centrifuges is used for the primary chilling of the solution, and direct expansion of ammonia is used to chill the solution to minus 45 degrees F.



Pipe still for lube oils—Courtesy Foster Wheeler Corporation.

Some research work has been done on mixed base oils to improve the viscosity-temperature coefficient by the separation of some of the unsaturated constituents by means of solvents. The subject of oiliness is receiving more attention and one of the larger companies is marketing a compounded motor oil which is showing remarkable performance.

Control Instruments

Since many of the refining processes have changed from the batch to the continuous stage, the importance of accurate control instruments has been emphasized. The human element cannot be relied on to control the more complicated units. Indicating and recording instruments had to be supplemented with control instruments. Through constant research work scientists employed by various instrument manufacturers have developed accurate and reliable devices for controlling pressure, temperature and rate of flow. In order to insure uniform products it is necessary to maintain uniform operating conditions.

Installation of Centrifuge machines for dewaxing.

Cracking

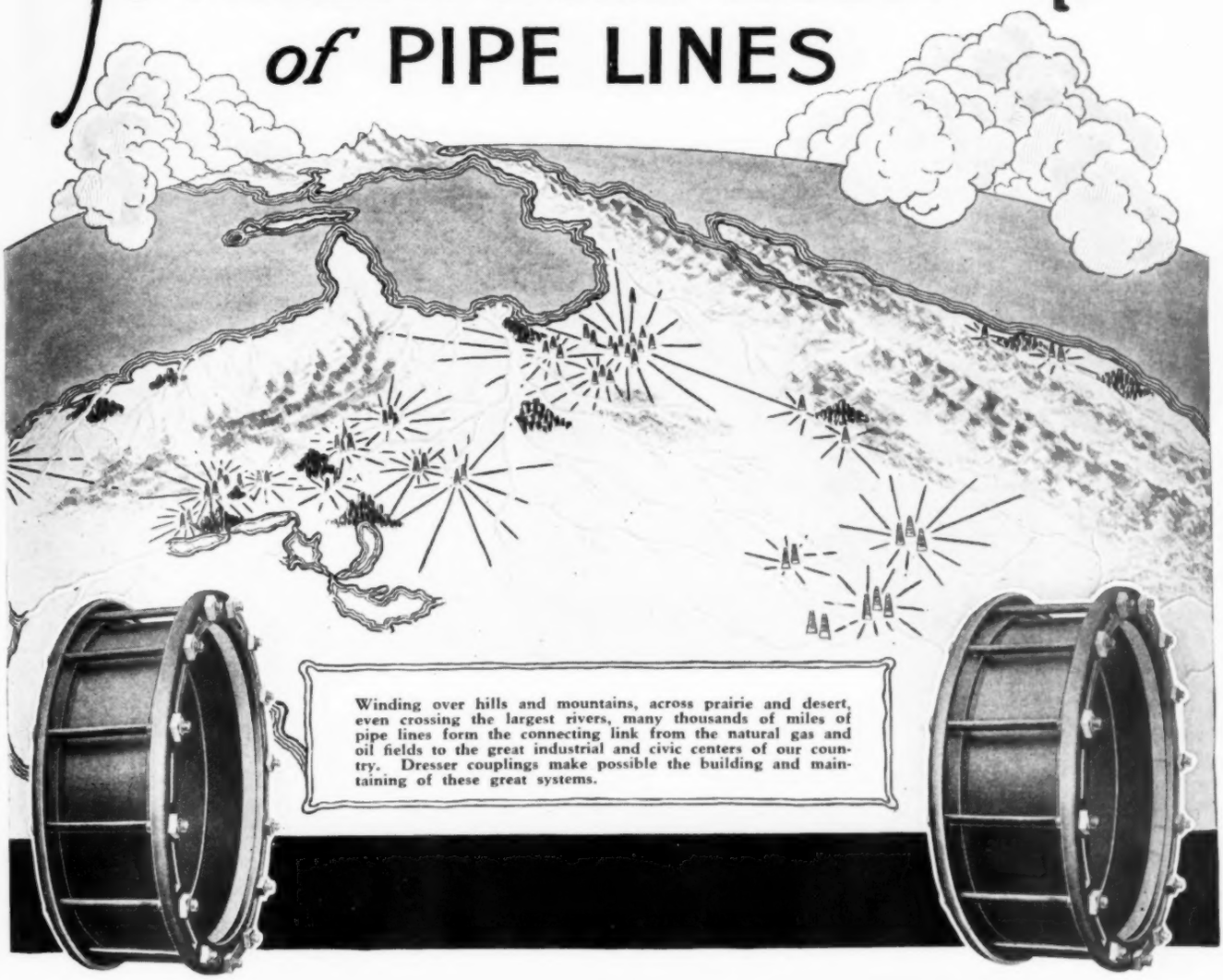
Due to the importance of anti-knock rating, much attention has been given to cracking processes and methods of treating cracked distillate. A new type of cracking unit has been developed by Luis deFlorez[6] and one by Donnelly.[7] Much attention has been given to vapor phase cracking on account of the high anti-knock rating of the product. Improvements in furnace design on cracking stills result in more efficient control and fuel consumption. Paul Truesdell[8] showed how nations without crude may safeguard their future by cracking.

Hydrogenation

The first commercial hydrogenation plant for petroleum will be placed in operation this summer at the Bayway refinery of the Standard Oil Co. (New Jersey), according to The Lamp (April, 1930). This plant will have a normal charging capacity of 5000 barrels per day.

[6] A. P. I. meeting, Dec., 1929.
[7] The Petroleum Engineer, March, 1930.
[8] The Petroleum Engineer, April, 1930.

A Nation Wide Hook-Up *of* PIPE LINES



Winding over hills and mountains, across prairie and desert, even crossing the largest rivers, many thousands of miles of pipe lines form the connecting link from the natural gas and oil fields to the great industrial and civic centers of our country. Dresser couplings make possible the building and maintaining of these great systems.

DRESSER COUPLINGS *Dominate!*

1880 S. R. DRESSER MANUFACTURING CO. 1930
BRADFORD, PENNA.

When writing S. R. Dresser Mfg. Co. *please mention The Petroleum Engineer*

Continuous Chilling System Used for

Manufacturing Wax-Free Lube Stocks

A RECENT development in the manufacture of wax-free lubricating stocks is a continuous chilling system using the refrigerating effect of the wax-free oil for the primary cooling of the solution. The flow sheet shows a typical plant layout for the continuous chilling of a naphtha solution from the blending temperature of 100 degrees F. to minus 40 degrees F. In the first stage, or the wax-free oil chilling towers, the solution is chilled to minus 25 degrees F., and in the second stage, or the ammonia chilling towers, the temperature of the solution is further reduced to minus 40 degrees F.

This scheme of chilling entirely eliminates the brine system and reduces the refrigeration costs about 50 per cent over the conventional method. By this system a zero pour point oil can be manufactured at a lower cost than a 15-degree pour point oil using the batch system. Since the wax-free oil flows through the coils under pressure, there is no danger of contamination with the wax-containing solution should any leakage occur.

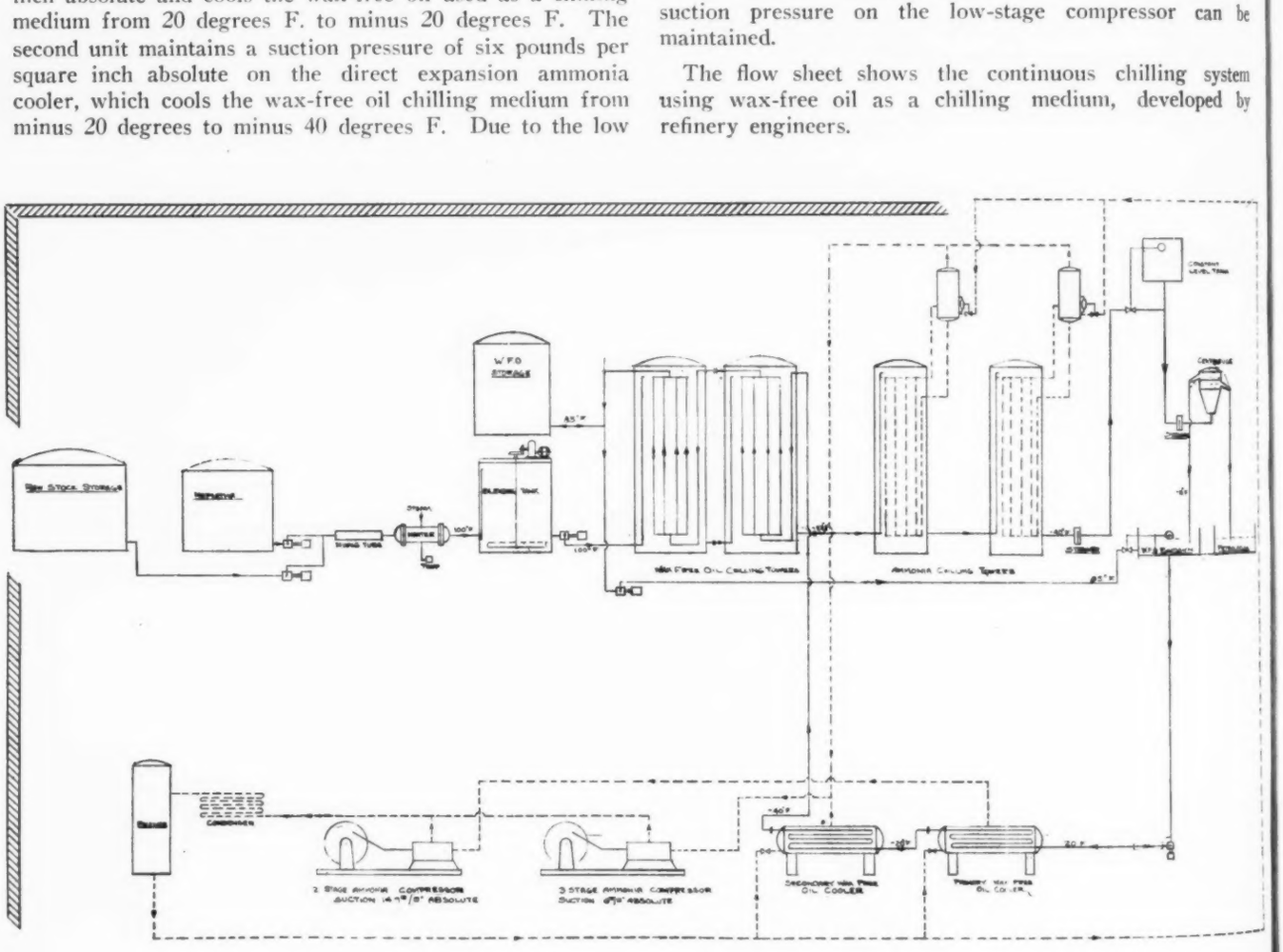
Two separate refrigeration units are used. One unit operates at a suction pressure of 14.7 pounds per square inch absolute and cools the wax-free oil used as a chilling medium from 20 degrees F. to minus 20 degrees F. The second unit maintains a suction pressure of six pounds per square inch absolute on the direct expansion ammonia cooler, which cools the wax-free oil chilling medium from minus 20 degrees to minus 40 degrees F. Due to the low suction pressure the second unit operates in three stages, while the first unit is two-stage.

Due to loss of volume by wax removal, the quantity of wax-free oil from the centrifuges must be built up approximately 20 per cent with warm wax-free oil from the first chilling tower. The temperature of this mixture will not be over 20 degrees F.

The solution is chilled to minus 25 degrees F. by means of the wax-free oil at a temperature of minus 40 degrees F. and then further chilled in the ammonia chilling towers to minus 40 degrees F. by the direct expansion of ammonia.

The elimination of brine as a chilling medium insures the recovery of all of the available refrigeration in the wax-free oil. A considerable saving of material and insulation results, since the system requires no brine-circulating pumps, brine storage tank and brine piping. A constant temperature differential is easily maintained between the chilling medium and the stock solution, as only one chilling medium for chilling the solution down to a temperature of minus 25 degrees F. is required. It is not necessary to maintain a differential back pressure on the accumulators of the ammonia chilling towers so that a more constant suction pressure on the low-stage compressor can be maintained.

The flow sheet shows the continuous chilling system using wax-free oil as a chilling medium, developed by refinery engineers.



Flexible Pipe Couplings Help in « «

Reducing Strains *on* Station Manifolds

By J. H. DAMERON

RE-OCCURRING troubles at pipe line station manifolds, caused by sagging lines, pump pulsations and contraction and expansion, have brought about various methods to overcome the troubles; many of which have been alleviated. Oil pumped from several units into a common manifold at varying velocities sets up a turbulent condition, causing reactance waves in the fluid which result in fluid hammer. If the manifold is rigidly connected the fluid hammer is frequently so violent it gives the entire manifold a severe jolt or strain, corresponding to each pulsation of the pump. The shorter the distance between the manifold and the units the greater the shock. In the course of time, depending upon the violence of the fluid hammer, some part of the manifold gives way under the strain.

Air bottles on discharge lines of reciprocating units are generally installed to flatten out the pulsation waves caused by the pumps and thus overcome manifold failures to a great extent. Often, however, the air bottles are not operated in connection with the pumps because the crews for various reasons dislike to care for them. In one instance it required a test to convince a station crew that the use of air bottles was desirable. Similar tests reveal the pump, operating without air bottles or alleviators, to be recording a 500 or 600 pound momentary jump in pressure with the shock corresponding to each pulsation.

On a pump discharging oil against a pressure of 500 pounds the pulsations gave a quick momentary shock that registered 1,100 pounds. Such momentary shocks as these eventually cause failures in the manifold and especially so if the manifold is located close to the station. With air bottles in operation under conditions approaching the ideal, some shock, however, is still transmitted to the manifold.

Contraction and expansion in the manifold house, and in the suction and discharge lines leading to it, ordinarily are cared for by making allowances for slack in the lines and bracing the manifold on supports. Sometimes, supports, which will permit a certain amount of crawling of the manifold, are installed either with or without expansion joints. Sagging lines, which either hang on the tank or manifold, usually necessitate the digging up of the troublesome line and reblocking it to bring it back in line and remove the strain which sagging causes.

In an effort to overcome several troublesome factors at a manifold the Prairie Pipe Line Co. isolated the manifold from the inlet and outlet joint with double lip ring type couplings at its Adding station in southern Oklahoma. This type of coupling has been in service for a period of several months and is proving quite satisfactory.

At the time the couplings were put in some trouble was being experienced with sagging lines entering the manifold. This either placed a strain on the connections at the tanks or placed a severe strain on the flanges and valves.

Large rigidly connected main line station manifold at a Kansas pipe line station.

In many localities sagging lines constitute a serious problem. Neither concrete or wood blocks used in connection with construction of the lines entirely overcome the sagging and its attendant evils. When using wood blocks there is always present the hazard of rocks or dirt falling under the block and throwing it off of the clean bottom of the trench. As the earth settles the line drops and starts sagging. In time the wood rots out and gives away.

Settling of earth likewise causes the concrete blocks to sink to some extent and permit lines to sag. Sometimes the pump pulsations help drive the blocks deeper with the result that the line sags and hangs on the flanges or connections.

At this particular station the sagging lines not only put a strain on the flanges and valves, but they were causing the concrete to break away from around the stuffing boxes. This made it more difficult to keep water off the manifold floor.

After installing the above described flexible coupling the method is apparently taking care of all of the sag in the lines. Close observation of the accompanying photograph illustrates how the coupling is keeping the strain caused by the sag in the line in the foreground from the

valve. The leaks around the stuffing boxes were repaired at the same time and are giving no further trouble.

The coupling will care for a small amount of contraction and expansion of the manifold. It is believed that where sufficient slack has been properly put in when the lines entering the manifold were built, that this feature will have been satisfactorily cared for.

The manifold under discussion is made more rigid with steel supports welded to narrow half circle straps under the bottom of the pipe and was subject to considerable strain. An example of the strain placed on supports by pump pulsations and contraction and expansion is found in a Mid-Continent station using concrete pedestal supports.

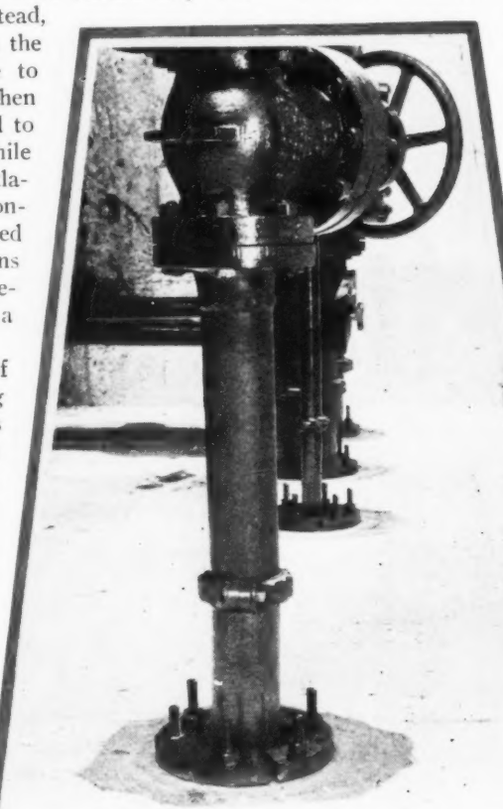
These pedestals were grooved on top and the pipe rested in the grooves. Severe strains and jolts caused by fluid hammer and contraction and expansion knocked the lips off the blocks. When the blocks were rebuilt they were constructed without grooves. Instead, flat pieces of iron were grouted in the cement. This permitted the pipe to crawl on the top of the block when contracting or expanding and yield to some extent to fluid hammer. While the supports at the southern Oklahoma station manifold are not concrete they are nevertheless saved from being subjected to many strains by the flexible coupling and consequently serve their purpose to a greater degree.

At this manifold the amount of fluid hammer the flexible coupling prevents from reaching the flanges and valves is clearly evident when the couplings are observed. With every pulsation shock the coupling moves forward, apparently its full distance of travel, and absorbs the greater portion of the jolt the flange and valve would otherwise receive. Another advantage of the flexible coupling is that it permits the removal of a section of the manifold with less trouble and effort. Frequently when a part of the manifold is to be removed for any cause and the pipe has been cut, it is almost impossible to pull out the severed section because it is wedged in so tight. When this happens it is necessary to cut away a section of the pipe in order to remove a valve or part of the manifold. With the flexible coupling this is less likely to occur because of the space between the two nipples which the coupling joins.

The speed with which the couplings can be made also is a factor in their favor, although this advantage is not one of great importance in manifold construction.

Since the installation of this type of coupling the flanges have required less attention and tightening. It follows, too, that the manifold has been easier to keep clean because of the absence of oil leaks and leaks around the stuffing boxes. By eliminating the strain placed on the valve and flange by sagging pipe, no trouble is experienced from valves difficult to open or close because their seat, rings, or disc, was damaged by the strain of a sag.

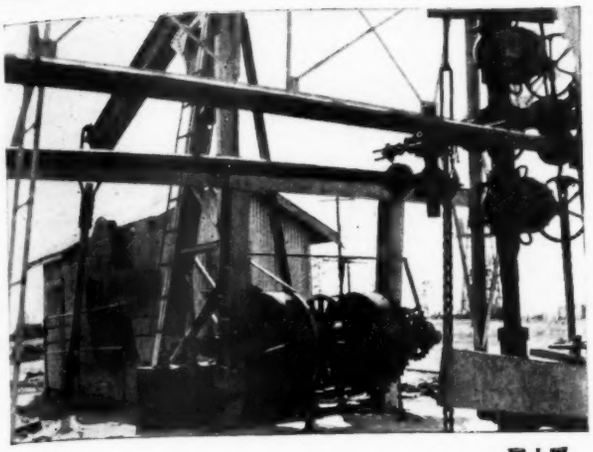
In the beginning it was found the flexible coupling would take care of a certain amount of misalignment. Although this type of flexible coupling does not overcome all the troubles encountered in manifold operation it has, in this instance, aided greatly is lessening the shock of pump pulsation to the manifold, cared for a certain amount of contaction and expansion and relieved the valves and flanges from the strains of sagging lines.



Top—Close-up view of flexible coupling in manifold.

Bottom—Manifold on a line under construction.

LUFKIN MODERN EQUIPMENT *means* ECONOMICAL PRODUCTION and A PERMANENT INVESTMENT



Humble Company, Williams No. 9, Humble field. Depth 4,892 feet, flowing 4,500 barrels. Equipment: Lufkin 6½-inch Herringbone Unit, No. 522 Hoist with steel jack posts, Samson Post, Beam and Trout Pitman.

1. Low Lifting Cost.
2. Low Operating Cost.
3. Low Maintenance Cost.

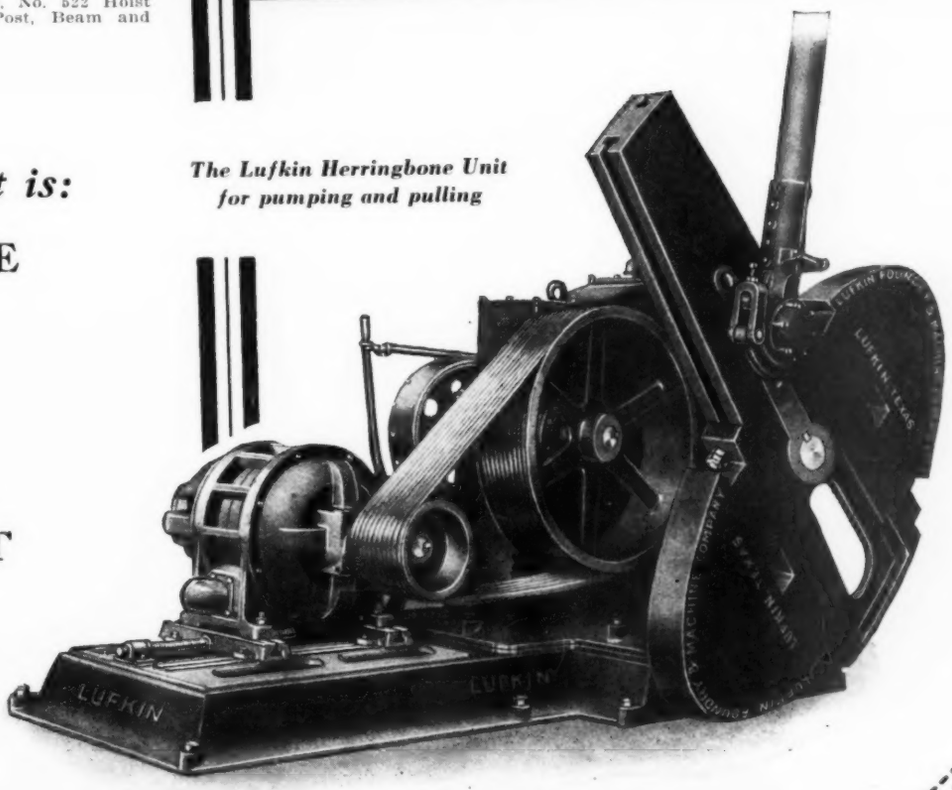
The three big reasons why major operators prefer Lufkin Equipment.

Lufkin equipment is:

DEPENDABLE
EFFICIENT
DURABLE
POWERFUL
SILENT
FIREPROOF
PERMANENT

Over 1500 Lufkin Units in Use

The Lufkin Herringbone Unit for pumping and pulling



May we send our catalogue?

Manufactured at Lufkin, Texas, by
THE LUFKIN FOUNDRY AND MACHINE CO.

District Offices
THE LUFKIN LINE **Tulsa, Okla. Houston, Texas** THE LUFKIN LINE

Los Angeles, Cal. Seminole, Okla. El Dorado, Ark. Odessa, Texas New York, N.Y.

Use Scissors Here

We are interested in Economical Oil Production equipment.
PLEASE SEND COMPLETE CATALOGUE
NAME
COMPANY
CITY
STATE

Oklahoma Plant Makes Dewaxed Oils

THE Champlin Refinery at Enid, Okla., has a capacity of over 15,000 barrels of crude oil per day. Selected crudes from the northern Oklahoma oil fields are processed. During the past year the company has had a large expansion and improvement program in progress which makes it a complete modern plant manufacturing lubricating oils, premium gasolines and various grades of greases and compounded lubricants.

The company has installed many up-to-date processes and much new equipment to further their manufacturing activity. The direct expansion chilling equipment used in the manufacture of completely dewaxed oils was put into operation in February of this year, and E. J. Slater, superintendent of the plant, says that it is giving excellent results. To further improve the quality of the lubricating oils, a vacuum pipe still is under construction for the manufacture of overhead bright stocks.

Distillation

At the present time the crude is reduced continuously in a battery of shell stills equipped with fractionating towers, taking off the gasoline, kerosene, gas-oil and wax distillate cuts.

The crude is reduced to a long residuum having a flash of about 500 degrees F., or to a cylinder stock having a flash of about 525 degrees F. After being processed the finished long residuum has a viscosity of 110-120 Saybolt seconds, while the finished bright stock has a viscosity of 150-160 Saybolt seconds.

Treating

The reduced crude is treated in a batch agitator with 66 degrees Be sulphuric acid. The acid sludge from this treatment is drawn into mixing kettles, where it is mixed with fuel oil or gas oil, and this acid fuel is then used as fuel for firing the stills. One of the accompanying photographs shows the lube oil agitator and the sludge fuel mixing kettle. After the sludge is settled and drawn off, the treated oil is contact filtered with fine clay. The mixture of clay and oil is heated in a pipe still to about 400 degrees F., then cooled, diluted with naphtha, and the spent clay is filtered out in a leaf type press. After the filtration the solution is pumped to the dewaxing plant.

Dewaxing

The solution is diluted so that it contains approximately 70 per cent (by volume) of naphtha and 30 per cent of stock. This solution is chilled down from the blending temperature of approximately 100 degrees F. to 40 degrees F. in insulated tanks containing brine coils. This cool solution is then pumped through the direct expansion ammonia chilling towers, which chill it to minus 40 degrees F. The solution at this temperature is then fed into the centrifuges, which completely remove the wax. The finished oil shows no cloud at 40 degrees below zero. The centrifuge plant contains 20 machines. Ten of these machines are the new enclosed vapor-tight type and ten of them—the original installation—are the open type. The dewaxed solution is then taken to a still which takes off the naphtha continuously.

Dewaxed Neutral

All the neutral oil used in blending motor oils has a zero pour test, a viscosity of 240 Saybolt seconds at 100 degrees F. and a minimum flash of 410 degrees F. open cup. The use of this high viscosity neutral eliminates the light, non-lubrication fractions and improves the volatility of the finished motor oils.

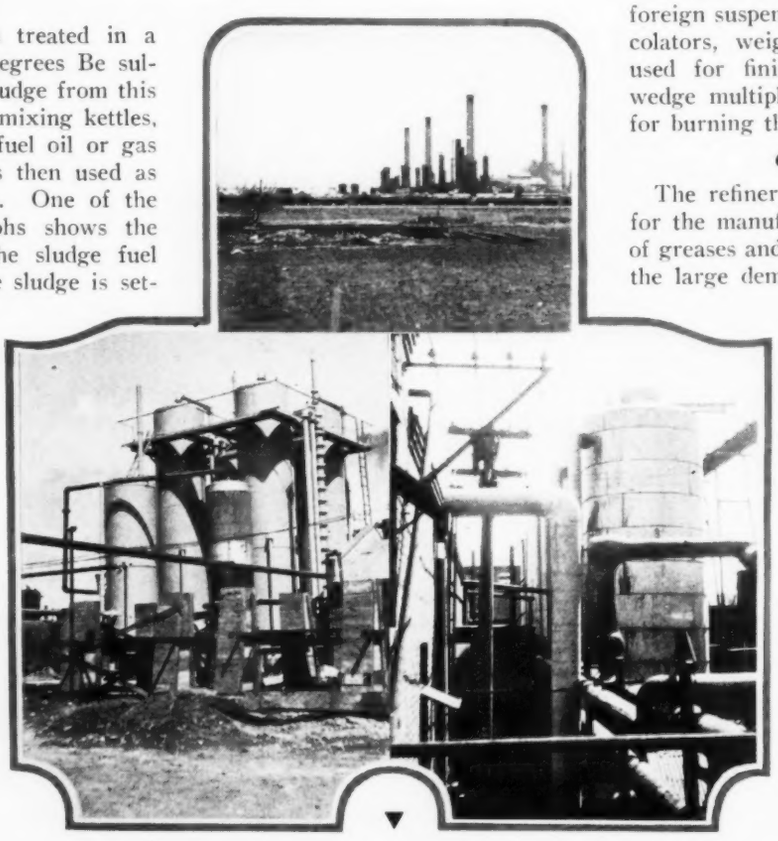
Percolation

All of the motor oils and bright stocks are filtered by percolation as the final step before shipping. This produces a good emulsion test, improves the color and carbon residue and removes all traces of fine clay and foreign suspensions in the oil. Six percolators, weighing 22 tons each, are used for finishing the oil. A large wedge multiple hearth furnace is used for burning the spent clay.

Grease Plant

The refinery contains a grease plant for the manufacture of a complete line of greases and compounded oil. Due to the large demand for these products a new and larger plant will be erected soon.

The Champlin refinery is equipped to ethylize its anti-knock gasoline, for which there is a growing demand.



Top—Distance view of the Champlin refinery at Enid, Okla. Below—Two inside views of the same plant.

Satisfactorily meeting the most exacting PIPE LINE requirements of the oil and gas industry

SPANG, CHALFANT & CO., INC.

General Offices: CLARK BUILDING, PITTSBURGH, PA.

Sales Offices: CHICAGO, ILL. NEW YORK, N. Y. ST. LOUIS, MO. PITTSBURGH, PA. TULSA, OKLA. LOS ANGELES, CAL.
Welded Mills: ETNA, PENNA. SHARPSBURG, PENNA. *Seamless Mills:* AMBRIDGE, PENNA.

Since 1828

When writing SPANG, CHALFANT & CO., INC., *please mention The Petroleum Engineer*

Correcting Abuses *of* Field Machinery

By **W. ANGUS ROSS, Consulting Petroleum Engineer**

THE oil industry, as befits its membership among the major industries of the country, expends millions of dollars annually on purchasing machinery and equipment. In recent years there has been a marked improvement in the purchasing methods employed, so that the old haphazard manner of buying blindly, anything that was

Setting engines for a gas compressor plant.

wanted without first ascertaining its every qualification for the task in hand, has gone to the discard.

There are still many articles bought on the spur of the moment for the industry, an ever-present reminder that the old habit of wanting and demanding stuff for yesterday rather than for tomorrow—or as it should be a tomorrow several weeks ahead—still persists, particularly in the first burst of enthusiasm prevalent in some newly discovered oil field. This state of affairs can oft be attributed to no more nor less than a lack of foresight.

An engine, motor or pump is mostly purchased nowadays only after careful study has been made of the information supplied by the manufacturers covering material of which the article is made, its guaranteed efficiency, the horsepower equation, if any, how constructed and its wearing qualities, the accessibility for repair work, its mobility from the point of view of removal to other districts, etc., etc., and, of less paramount importance than formerly, its price. Only after comparison on all these points between all the offers received, is the decision made and the order to purchase given to one of the bidders.

Spoiling Good Work

This advance is all to the steady improvement of the industry and its greater efficiency, but impairing the very efficiency attained is that done with the article the moment it is put into operation. The machine, purchased only after searching investigation and because it meets the users' high requirements better than any other manufacturer's product, is sometimes turned over for operation to the hands of, not skilled machine artisans, as might be imagined, but to help which is willing, no doubt, but sufficiently untrained to warrant the equipment being entrusted to their care.

The owner of an expensive automobile would not permit an Amazonian Indian to drive it if he knew the latter to be viewing a car for the first time in his life. He turns the car over to hands which are accustomed to that particular make and can prove it. This is sound practice, and the principle is just as applicable to industrial machinery as to privately owned automobiles. Then why will the oil industry still persist in occasionally placing the operation of machines and equipment, worth millions of dollars, in the hands of untrained operators, whose very lack of experience prevents their thorough understanding of the article and consequential distraction from its highest working efficiency? All the careful work in the factory, all the care, discretion and discernment of the oil company superintendents and executives prove abortive if improper hands guide the destiny of the factory product in the field.

When expert mechanics are employed to operate this machinery a great deal of grief is eliminated. That the damage and abuse to equipment costs many a company a staggering figure will be subscribed to by numerous producing, pipe line and refinery companies. Who hasn't seen an engine, worthy product of a worthy factory, ruined by the too sudden application of cold water through the engine jacket after discovery by the operator of it overheating because of vapor lock in the jacket stopping water circulation? A little sound knowledge here would have well served many an operating engineer, saved his employer much money and he himself his job. And what a large

A deep pumping well in Texas.

amount of equipment now rests on the scrap heap because of improper, irregular, and irresponsible lubrication?

Train the Operators

What is the remedy for these field tragedies? The obvious would be the employment only of thoroughly trained mechanics. A simple matter of present-day economics renders that impossible; the mechanic could not command in the field the rates his trade union gets him in the industrial world.

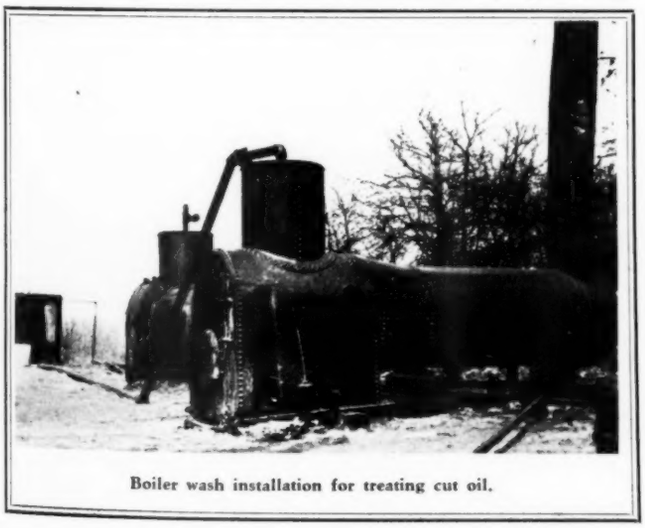
In view of this situation, the suggestion of the writer would be to take the material at hand at present and train it. Teach the operating staff how to run with efficiency and economy the equipment entrusted to it. And if they can't come to school to learn, then unlike Mohammed let the school go out to the pupils.

And the teachers? There are worlds of them available and begging to be given the opportunity to impart to these men the knowledge that is desired. I refer to the service men of the manufacturing companies. They are the ones best versed in the products they represent and therefore best suited to talk about them. And just how willing they would be to go out and spread the knowledge that is so essential can be gauged from the numerous entries in their company books showing how often they have had to stand the expense of repairing and replacing equipment they had sold, which, in improper hands, has become damaged and ruined, which they (the manufacturers) could prove was no fault of their own, but could not get that proof accepted by the user.

Lectures in Every District

The manufacturers and their representatives would welcome any opportunity to tell of their products, how to run, treat and look after them, to tell what should and should not be done under certain circumstances and happenings, how to get the highest efficiency out of the machine, and how, in a word, matters in general could be immensely improved. Such improvement would mark the beginning of a shut-down time curtailment, better usage of equipment, its longer life and marked reduction in spare parts and renewals ordered. To the manufacturer, the results of this suggested schooling would mean better contented customers and an industry fully appreciative of his efforts to help.

If the suggestion outlined in the foregoing is approved as worthy of consideration, or better still, adoption, the writer would advise the creation of some district committees representative of all the oil companies who have machinery which they wish to see better used. These committees could then draw up a curriculum, and with that approved, approach the manufacturers in the matter, enlist their sympathy and aid, and close details as to when and where the lectures would be delivered. It would doubtless best suit all parties if it were so arranged that the day the lecturer arrived to tell of his product, he would be addressing a mass meeting of all available operators, pumpers and such in the district, irrespective of what company they worked for. To eradicate any casual element in this matter, let the company officials order their employes attendance at those lectures. That would furnish the employer with a basis on which to work up an efficiency card per employe, which, when the course was over, would help in the determination of these who have bettered themselves and the selection of the most able.



Boiler wash installation for treating cut oil.

Cellar hook-up on a deep well in Oklahoma, showing rotary chain used in anchoring.

Course, Technical But Simple

The course could be spread over a period of time to permit of various machines being dealt with, giving students every opportunity to thoroughly assimilate the knowledge imparted. To lighten this task of the employe, the lecturers would, of necessity, have to speak in the understandable terms, making the matter as non-technical as possible, and only covering such aspects as it is necessary to stress. The student should be enlightened on the composition of the machine, of what metal the shafts and bearings are made, its "innards"; and to give him a complete picture of the latter, it is advisable that one of the machines under discussion be taken down and reassembled in front of the men. The right kind of packing and how to use it should also be emphasized, what gaskets are best suited for the purposes in hand, how to lubricate and with what.

Trained Operators an Asset

The suggestion for the above instruction is urged by one who has seen years of abuse rather than use made of machinery and equipment and who feels that some such a scheme as outlined should certainly be adopted.

The Chief ACCESSORY

THE ONLY BOMB BETTER THAN A ZERO HOUR BOMB IS TWO ZERO HOUR BOMBS .... AND THAT'S THE ZERO HOUR DUPLEX

to

FAULTLESS SHOOTING

Zero DUPLEX Hour
Electric Bomb
Plug and Socket Connectors ..... Improved Firing Pin

Its use in difficult shooting feats, where the strictest dependability is required, points ever more strongly to Zero Hour Duplex Electric Bomb detonation as the chief accessory to faultless shooting in the run of regular jobs. The thing that performs in a crisis is best for every day. No men know this better than those who use Zero Hour Duplex Electric Bombs all the time, using one as readily in a pinch as in practice.

The Zero Hour Duplex Electric Bomb contains two watches and two sets of blasting caps where one was contained before—all in the same size, metal, fluid-tight container as before. In this manner, two complete timing and firing mechanisms operate independently of each other, reducing the chance of a failure to the smallest comprehensible figure. All attachments are simplified by plug and socket connections, assuring perfect electrical contacts by merely pushing in a plug. The gold spring firing pin holds accurately to the "O" firing point, no matter how often the hour hand passes forward or backward across it, in testing.

When you are collecting into your shooting habits the best aids for perfect shots, remember that the chief accessory is a Zero Hour Duplex Electric Bomb.

Zero Hour
Electric Bomb

Zero Hour Bombs are obtainable through all principal torpedo companies.

ZERO HOUR TORPEDO CO., 408 COSDEN BLDG., TULSA, OKLA.

When writing THE ZERO HOUR TORPEDO COMPANY *please mention The Petroleum Engineer*

» » » Engine and Pump « « «

Lubrication *in* Pipe Line Stations

WHEN the Prairie Pipe Line Co. built its Panhandle Texas line to connect with its Mid-Continent system a few years ago particular attention was given to lubrication of the oil engines and reciprocating pumps. An example of how these problems were handled is found in the company's Adding station at Addington, Okla.

The station capacity is around 50,000 barrels daily against a line pressure of around 700 pounds. The pumps discharge into two lines, one an 8-inch and the other a 6-inch, and two grades of crude, Mid-Continent and Panhandle, are handled.

The power plant is comprised of two 400-horsepower vertical Diesels driving two 6 by 24 horizontal pumps. When each unit is handling around 1,065 barrels per hour the engines are operated at a speed of 235 r. p. m. and the pumps are making 44½ strokes per minute.

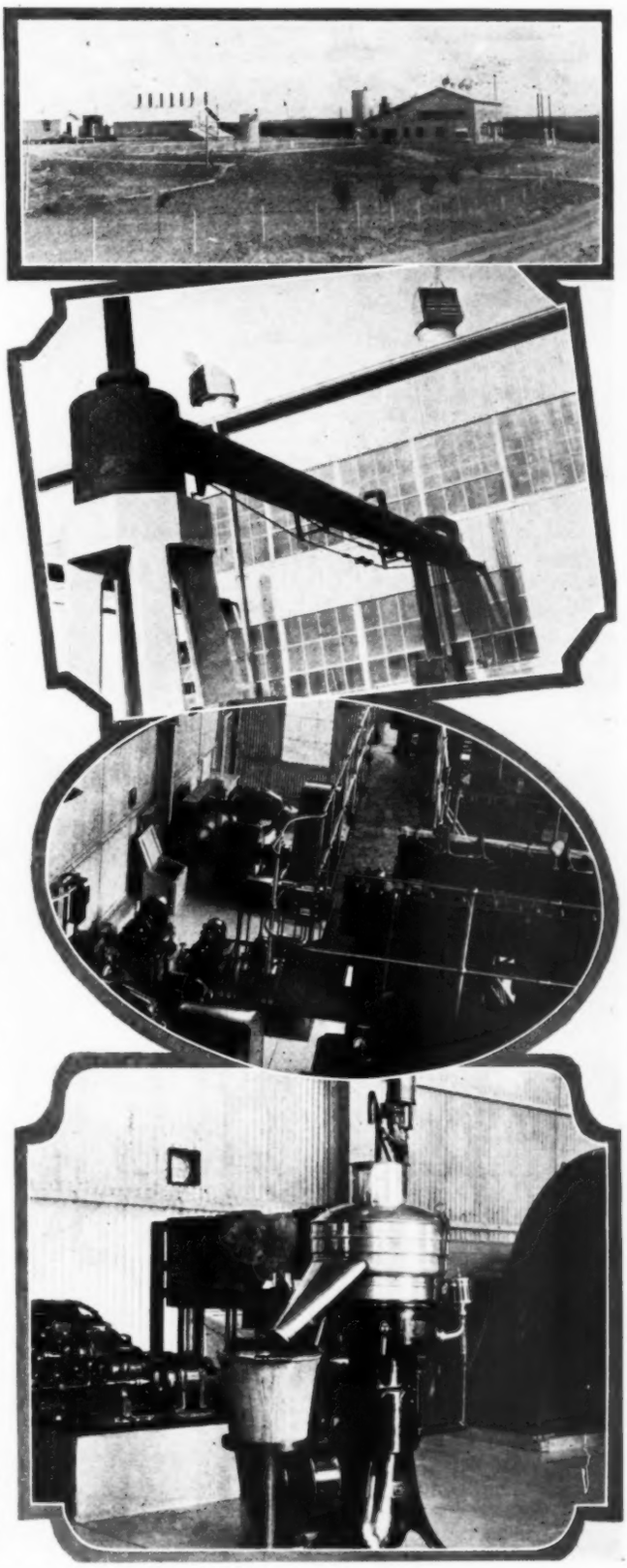
All of the station piping is located in a concrete walled cellar beneath the engine room side of the station which lends itself ideally to the locating of the lube oil lines, heat lines, sumps and heaters.

All lubricating oil, both for the engines and pumps, is centrifuged. The engine oil is continuously clarified except for those short periods when the centrifuge machine is used to clean the pump lubricating oil. The layout for handling the engine lube oil is practically the same as that found in any pipe line station running lubrication oil through separators or reclaimers.

Soon after the installation of the engines it was decided to improve cylinder lubrication by installing a lubricator on the side of the engine. Formerly liner lubrication was accomplished with the splash system and with the lubricator a little too much oil found its way to the cylinders. This condition was corrected by putting wiper rings on the pistons.

The greatest change in the lubricating system was on the pumps where a pressure system did away with gear grease for the gears and eliminated most of the cups on the bearings. This was accomplished by the installation of an overhead tank, which was high enough for the required pressure, and a somewhat unusual layout.

An overhead tank was built alongside the engine lubricating oil tank. A line, entering the tank a few inches above the bottom, goes over to the pump room side of the station to a header. Another line, located in the bottom of the tank, connects with a line running from the bottom of the engine oil tank to the centrifuge. By manipulation of valves on the line either tank can be turned into the centrifuge. By a similar arrangement on filling lines from the clean oil sump the clean oil may be discharged into either tank.



Top to bottom—General view of Adding station. Jacketed exhaust for hot-water heating system. End view of engine room, showing generators and enclosed fly wheel. Lubricating oil centrifuge machine.

When the oil comes into the one-inch header in the pump room it is directed to the bearing surfaces through smaller pipes. From these it flows through sight feeds or direct to the bearing surfaces.

Two half-inch lines supply the oil to the perforated header inside of the gear guard. The lines enter the header on opposite sides. The header is perforated with 30, one-sixteenth holes. It is located so the streams of oil flow directly on the gears just as they mesh, and this has a tendency to wash the gears constantly.

Sometimes it is difficult to keep the perforations open and consequently some trouble may be expected from clogged perforations. This, however, is of minor importance because some member of the crew checks the pump several times every shift and the trouble, in most instances, may be corrected with little effort.

Since the installation of this method no trouble has been encountered as a result of inefficient gear lubrication. There is some difference of opinion concerning the wear of the gears, but after several thousand hours running they appear to be in excellent condition.

Most of the bearings are lubricated by the same system. The bearings are grooved to permit an even distribution of the oil to all surfaces. Since this method has been adopted the pumps have operated more than 11,000 hours and the first bearing trouble is yet to be reported. As a result the bearings are running cooler and require less attention.

The oil from pump lubrication points drains into a separate sump where it is picked up by a small motor-driven pump and discharged to the overhead tank. Relatively little dirt accumulates and this is removed by batching the oil through the centrifuge. The more frequently the lube oil is clarified the less trouble is experienced from clogged perforations in the gear header.

Several factors entered into the decision to lubricate the pumps from a separate tank instead of from the same tank containing the engine cylinder and bearing oil. The Diesel oil is a more expensive oil and has a viscosity of around 400 and is probably too light for pump lubrication in general. The oil for the pumps is a less expensive product and its viscosity is around 150.

In addition there is the possibility of crude oil from the pumps getting into the engine oil if both pumps and engines drew their lubricating oil from the same tank. With two tanks the lighter Diesel oil is used for the engines and the heavier oil for the pumps.

Make up oil for the pump lubrication is very economical running well under a barrel per month. This is principally because the pumps are new and have been kept in excellent repair. Consequently little oil is lost through leakage.

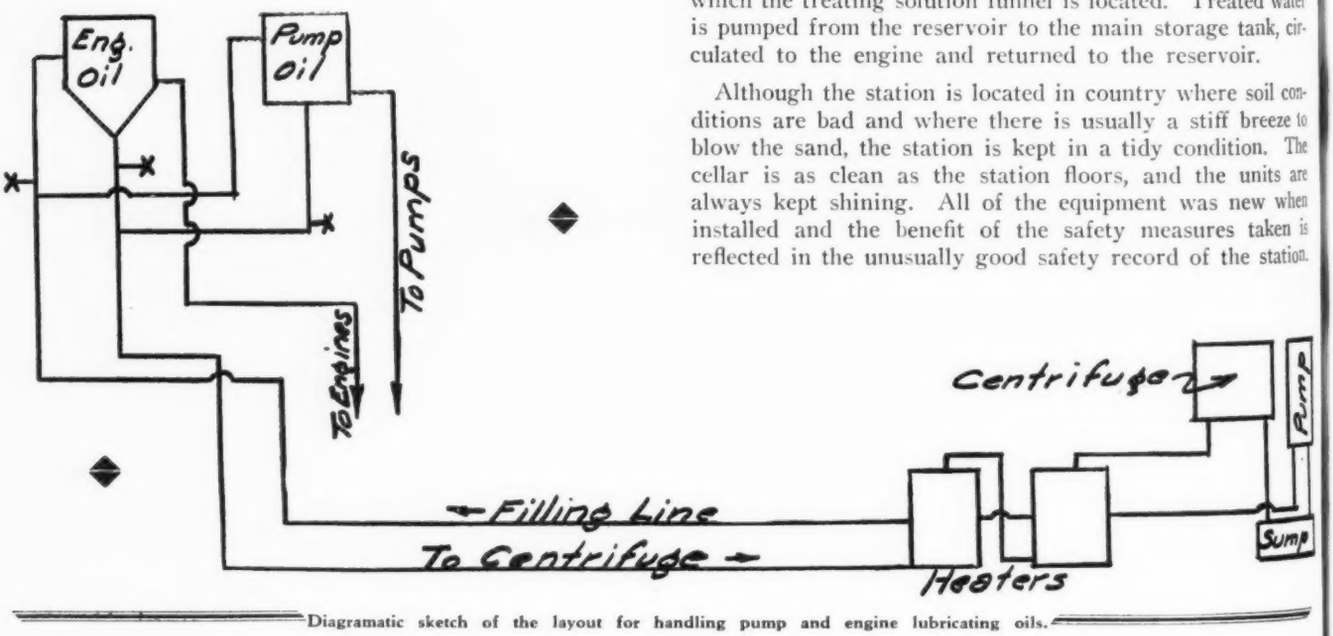
In connection with clarifying the lubricating oil the station has a somewhat elaborate heating system which is also used to heat fuel oil for centrifuging and to heat it before going into the engines. Because the station pumps Panhandle crude, which congeals in cold weather, a steam plant is located at the station to generate steam for the heat exchanger used to heat this oil during the winter. When the hot-water system fails to hold temperatures during the cold months its temperature is raised by steam through lines connected to the hot-water system.

The water for the system is heated in a jacket on the engine exhaust, and is circulated by a small motor-driven pump. All of the water lines are insulated to hold the heat. During most of the months this system suffices for all purposes. The water is circulated from the jackets to the two heaters connected in series. All oil to be centrifuged goes through both heaters. They are built with 18 or 20-inch pipe four feet six inches long and contain 89 copper tubes. By having two in series it is much easier to raise the temperature of the oil to be clarified.

After going through the heaters the water is circulated through coils in a cone-bottom tank on the tower supporting the station's small tanks and heats the fuel oil before it is centrifuged. The clean fuel is also heated by a similar layout during the winter months. If the clean fuel loses too much heat before it reaches the engine a half-inch steam line is used to raise the temperature. The fuel line is jacketed for a few feet close to the engine and the small steam line enters into it and is controlled by a valve on the line near the end of the engine.

The water supply is similar to that found at most pipe line stations—in need of treatment. Since a reservoir was built it was made attractive with well-built and painted fence. The appearance was improved by building a spiral ladder to the top of the treating tank to the platform on which the treating solution funnel is located. Treated water is pumped from the reservoir to the main storage tank, circulated to the engine and returned to the reservoir.

Although the station is located in country where soil conditions are bad and where there is usually a stiff breeze to blow the sand, the station is kept in a tidy condition. The cellar is as clean as the station floors, and the units are always kept shining. All of the equipment was new when installed and the benefit of the safety measures taken is reflected in the unusually good safety record of the station.



Diagramatic sketch of the layout for handling pump and engine lubricating oils.

Large Turn-out Makes » » »

Reclamation Plant *an* Economical Unit

A RECLAMATION plant that started on a small scale, and as more or less of an experiment, has so proven its worth that now, through additions to the shop, the Indian Territory Illuminating Oil Company has perhaps the largest company reclaiming plant. The plant is located on the company's Wisey Bowlegs lease in the Bowlegs field of the Greater Seminole (Oklahoma) district.

There was only a small installation cost attached to the erection of the plant. Most of the buildings were formerly used as warehouses. The principal expenditures were for two lathes, a sandblast machine, a compressor and a few other minor items. The small installation cost and the large turnout of material has made the investment a very satisfactory one.

All pieces of material coming to the shop are cleaned, repacked, refaced, rethreaded, reset and straightened, if needed. All equipment is painted and new parts installed when necessary. Every item is tested before being sent to the field again. Some of the equipment has been through the shop several times, but is reconditioned for further use in the field. Valves, pumps, generators, ignition equipment, boilers, separators, pipe and tubing, as well as all kinds of fittings, pass through the shop regularly.

Cleaning casing with sandblast.

A feature of the operation of the plant is the use of a sandblast machine for cleaning corrosion, rust and other foreign material from any equipment that may be sent to the reclamation house. This machine is identical with the ones used in the East for cleaning building walls. It consists of a round cylinder with a hose attached.

The material to be cleaned is placed upon a rack, where it is sprayed with sand coming through the hose connection from the sandblast machine. The normal working pressure is approximately 100 pounds, and it generally takes five minutes to clean a large-size valve. This method not only offers a quick one for removing the dirt, but a very thorough one.

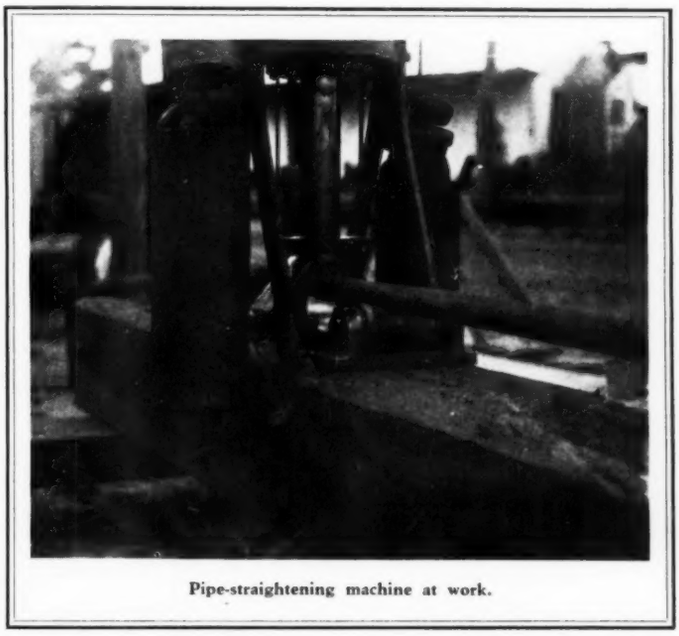
A small room in a corner of the valve and pump reclamation shop has been made into a sandblast room. It is tightly sealed to prevent the sand from sifting through into other parts of the valve shop. In order to give as much air as possible to this room it is equipped with an open skylight.

H. A. Lippert is sandblast operator. Lippert wears, in addition to goggles, a breathing apparatus, a helmet that comes down over his face to his shoulders, and a pair of heavy gloves. Rufus Hood is helper.

The sand used is regular river-bed sand. It is first passed through a trough over the top of a boiler used to develop the steam pressure. The sand is thoroughly dried out in passing through the heat generated by the boiler. There is no loss of sand, as it is reused many times. When it becomes very fine grained it is used to clean pipe and tubing.

The shop is kept running throughout the 24 hours, with three eight-hour shifts. The sandblast is operated only during one of these shifts, in that time cleaning enough valves or other equipment to keep the other two shifts, as well as its own shift, busy resetting and repairing.

Every joint of pipe is graded and inspected before going into the pipe shop. Racks are systematically arranged for cleaning, grading and straightening before going into the pipe shop to be rethreaded or perhaps grooved. It is then placed upon a rack for painting. It is coated with a crude oil coming from Lamont, Kansas.



Pipe-straightening machine at work.

A small pressure gun is used to spray the paint upon all items. The paint color for all, except the pipe, is green.

The installation of the sandblast has materially speeded up the work. It was in operation for the first time on December 4, 1929. Since that time the plant has been handling nearly four times as much material as previously.

Last month two carloads of fittings were shipped from the plant to the Indian Territory Illuminating Oil Company at Oklahoma City for use in that field. An average of one carload of pipe is reconditioned each day.

Although at this time much more equipment is being refinished, the record of the shop during the 1929 year was quite large. Total footage of all tubular goods reconditioned during the year was 297,362 feet, 149,267 feet in the first eight months and 148,095 feet in the last four.

FROM GRINDERS --

STOODY UNIVERSAL OIL-TOOL GRINDER
STOODY COMBINATION GRINDER
STOODY FLEXIBLE SHAFT GRINDER

To

— IN MANY SIZES AND SHAPES —

Stoody Products Have Won First Honors in the Oil Fields of the World

UNLESS YOU ARE USING THEM YOU ARE NOT USING THE BEST

STOODY COMPANY

Manufacturers of

Welding Rod • Alloy Steels • Equipment

WHITTIER, CALIFORNIA

When writing STOODY CO. *please mention The Petroleum Engineer*

Some Phases *of* Airplane Engine Oils

« « By E. R. IRWIN » »

Asst. Aero. Chemist Material Division U. S. Army Air Corps.

FOR the lubrication of an internal combustion engine the oil must possess at least two essential characteristics: (1) It must be of the proper viscosity and (2) it must be resistant to decomposition by heat. In cold weather it must flow as freely as possible and must allow starting as easily as possible. Oiliness may be of importance in some cases. Consumption should be low, but should be considered after other more important features.

The requirements mentioned will be discussed in order except that consumption will be considered with viscosity. Of course, no oil should be used which contains compounds corrosive to metals, but it is believed that none of the recognized aircraft oils on the market are effectually corrosive and the topic will not be pursued further.

Author's Note—This article is not to be construed as representing the opinion of the engineering personnel of the Air Corps. It is the personal opinion of the author at the time it is written. Further, no comparison of lubricating oils produced by the various refining methods nor from the various crudes is intended.

Viscosity

The oil in the conventional aircraft engine is subjected to very severe duty and a heavy and well-refined product is therefore necessary. The bearings operate at high temperatures with heavy loads. Oil temperature regulators are frequently used, but must be as small as possible to decrease weight and air resistance. The oil, therefore, runs hot, from 150 degrees F. to 200 degrees F. The cylinder wall temperature is high on air-cooled and glycol-cooled engines and not low on water-cooled engines. No exact figures can be given, but an estimate of 375 degrees F. and 325 degrees F., respectively, is not considered excessive.[1] The oil must seal and lubricate at such temperatures. The bearing pressure in modern engines is from 1500 to 2000 pounds per square inch. An oil temperature of 160 degrees F. to 180 degrees F. is considered normal. From these figures it can be proved with the aid of certain data on the action of lubricant films (reference will not be given), that a minimum viscosity of 160 S. U. V. at 210 degrees F. will be required. Recent work[2] shows, however, that viscosity is not the determining factor in film failure. As oils all the way from 60 to 150 S. U. V. are used under various conditions, it would appear that the best method of selecting the proper viscosity is by observation of actual operation rather than by lubricating engineering data.

Present specifications usually describe oils of from 60 to 140 S. U. V. for air-cooled engines, including the extremes of climate. For water-cooled engines a narrower range, from 80 to 120 is preferred. Excessively high viscosity is undesirable. The oil is not distributed as well while cold, consumes more power in starting, and, other things being equal, deposits more carbon. Low viscosity involves high oil consumption and possible failure of the lubricant film. It is general opinion that the lightest oil which will do the work should be used. The viscosity of the oil as it passes from the bearings is a factor in piston lubrication and oil consumption. The pistons depend on a free throw of oil and also an oil of sufficient body. If the oil is too heavy it will not be properly distributed. If too light, excessive consumption and wear will result. Starving the pistons by an excessively heavy oil is worse than the use of an oil which is too light, assuming the same error from the best viscosity. From the results of Air Corps tests it appears that the most desirable viscosity is about 200 to 250 S. U. V. at normal oil temperature. The practical working range is very wide and the limits are difficult to set. A minimum of 120 and a maximum of 350 is suggested. Viscosities above 300 reduce consumption, but do not circulate well and may result in stuck piston rings. The author does not wish to place himself in the ridiculous position of arguing that a high oil consumption is desirable, but only wishes to point out that a low consumption is not proof of superiority unless the viscosity is known to be correct. The relative volatility of the oil and its resistance to chemical decomposition are also factors in oil consumption. It is possible, therefore, to find oils of the same viscosity which show different rates of consumption, which should be considered in estimating their relative value, as an oil which shows low consumption normally shows slow deterioration as well as saving of oil.

While 200 to 250 S. U. V. viscosity at normal oil temperature is recommended, in no case is a viscosity of less than about 70 at 210 degrees F. recommended. An average oil of this viscosity will have a viscosity of 300 at about 130 degrees F., which indicates the minimum desirable oil temperature. If the normal oil temperature is below 130 degrees F., the cooling should be reduced to maintain the oil at some higher temperature, say 150, and an oil of 80 to 90 S. U. V. used. In a like manner it is considered preferable to keep oil temperatures below a maximum of 200 degrees F. rather than to use an extremely heavy oil. The viscosity-temperature figures used throughout are based on average viscosity-curve oil. Eastern oils will, of course, be lighter, and Texas and California oils heavier, at the lower temperatures.

Resistance to Decomposition

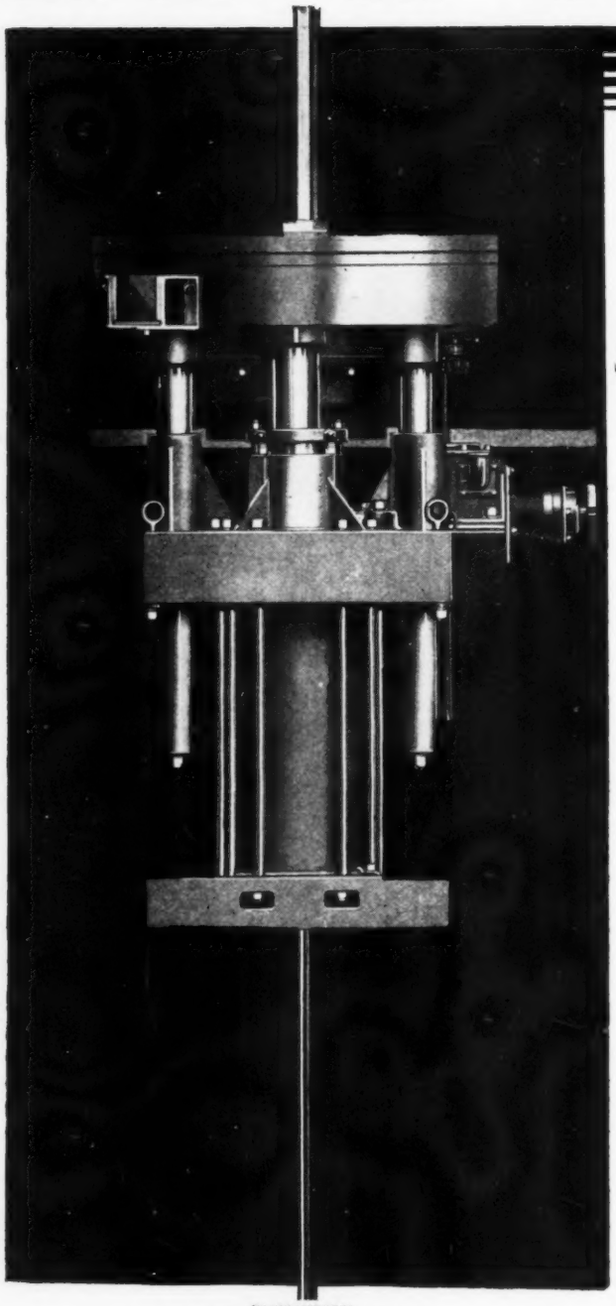
In order to reduce the cost per mile of lubrication it is desirable that the "life" of the oil be as long as possible. During use in an internal combustion engine all oils more or less rapidly deteriorate due to oxidation or polymerization. The obvious effects of this change are (1) an increase in acidity, (2) an increase in viscosity, which is probably due to the formation of soluble tarry or resinous compounds and (3) the formation of insoluble material, "sludge".

While it is easily possible to produce in the laboratory effects which are apparently similar to those obtained in engine operation, no laboratory tests have been examined

[1] Personal conversation with representatives of engine manufacturers.

[2] This reference is to a very interesting paper by General Motors Research Corporation, presented before the A. S. T. M. The idea that heavy oils are essentially better than light oils is shown to be incorrect.

HYDRIL



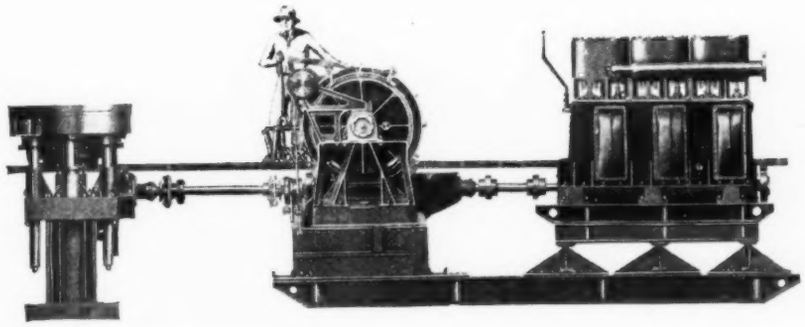
THE most vital requirement in straight hole drilling is to prevent excessive pressure on the bit. Too much weight puts the drill string into compression ...causing it to flex and buckle ... forcing the bit off its intended vertical course. Constant knowledge and accurate control of drilling weight is an outstanding advantage of Hydril.

The drill pipe is suspended from the Hydril rotary table and hangs vertically ... like a plumb-bob ... only the weight of the drill collar and bit bearing on the formation. Any formation condition tending to deflect the bit is automatically overcome by gravity pulling the SUSPENDED weight back to vertical ... like a plumb-bob, regardless of the depth of the hole.

Accurate knowledge of bit pressure at all times is supplied by a gauge operated from the hydraulic cylinders which support the rotary table, and the rate of feed is instantly controlled by opening or closing a valve. When the "plumb-bob" principle of keeping the string always in tension above the drill collar is uniformly applied there results a VERTICALLY STRAIGHT HOLE...drilled in the shortest time with a minimum of cost and trouble.

TRADE MARK REG.
HYDRIL

"PLUMB-BOB" DRILLING Guarantees Straight Holes!



3 COMPACT UNITS

No other deep drilling equipment is so compactly designed . . . so durably and strongly made for roughest, longest service.

All materials are of the best...accurately machined to close tolerances and strictly inspected. Oversize roller bearings are used throughout.

Each unit it self-contained and rigidly mounted on its own base. 1, the Hydraulic Rotary Table... 2, Draw works... and 3, the Vertical Steam Engine.

For quick installation engine and drawworks can be mounted on a steel frame as shown in the cut.

Every part is easily accessible. All drive shafts are under the floor, leaving clear, safe working space for the crew.

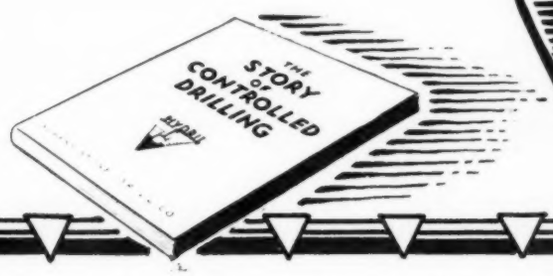
These compact units may be speedily moved out, loaded on trucks, and transported to drill new wells in other locations or fields.

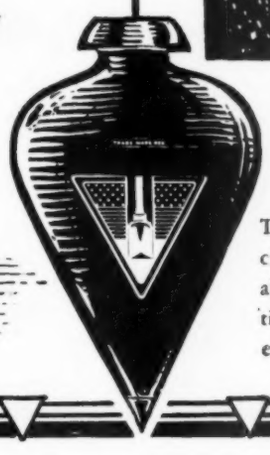
DOHENY STONE DRILL COMPANY

714 West Tenth Street . . . Los Angeles, California

Cable Address . . . Hydril, Los Angeles

Send for Your FREE copy of this Valuable Book.





The "Plumb-Bob" principle drills holes vertically straight in shortest time and with minimum expense and trouble.

by the Air Corps laboratories which could be converted into engine performance. The tests commonly used are the Conradson (American), and the Ramsbottom (English), carbon residue tests; the Sligh, the British Air Ministry, and various other oxidation tests, depending on treating the oil with air or oxygen at elevated temperatures; bearing tests, and, finally, the various attempts to isolate the undesirable compounds by chemical or physical means. At present, service tests seem to be the only certain way of determining the life of the oil. As these tests must be long and carefully controlled and observed, with frequent examination of the oil and the engine, they are very costly. The two oxidation tests mentioned above and the various bearing tests are certainly of some value in predicting serviceability. The carbon residue tests, considered in conjunction with other tests, are an indication, but all laboratory tests have their exceptions and limitations. It is believed that in the course of time some practical and accurate labbratory test will be developed, obviating the long and expensive service test routine.

Service test data should include the formation of carbon deposits in the combustion chamber, ring sticking, and change in the oil as mentioned above. Vulnerable parts should be measured with a micrometer at intervals. Darkening of the oil, provided it is not accompanied by sludging, is not harmful.

Cold Weather Operation

Operation of aircraft in cold weather involves an additional requirement for the oil and therefore more care in its selection. It must not offer great resistance to starting and it must flow as freely as possible, still being of sufficient body to insure lubrication when warmed up.

In sub-zero weather this is not possible and oil and water may be heated before servicing the engine or an air-cooled engine should be heated externally if heated hangars are not available. The change in viscosity of mineral oils is so great that at temperatures near and below zero Fahr. starting an engine using the lightest oil possible without preheating is very difficult indeed. For temperatures from about zero to about 40 degrees F. the use of an oil of about 100 S. U. V. at 210 degrees F., with low temperature-viscosity-change and pour test controlled as carefully as possible, is recommended. For the lower temperatures lighter oils should be used unless the oil temperature can be maintained above 150 degrees F. in flight.

The viscosity of the oil at the temperature encountered is the determining factor in resistance to starting and may be established in a relative way for any two or more oils by the use of a straight line viscosity paper. The pour test is of minor importance in starting. The distribution of the oil is affected both by the viscosity and the pour test. A low viscosity at low temperatures, therefore, does not excuse a high pour test. If asked to choose between an oil of low-temperature viscosity having a high pour test and an oil of high viscosity at low temperature, but having a low pour test, one could only say that both are undesirable. It must be remembered that starting an airplane engine in zero weather with the best cold-weather oil obtainable is very difficult, due to the heavy oil required for proper lubrication. It is said that oils of intermediate viscosity-temperature change are satisfactory for winter use when dewaxed to bring the pour test to zero F. In regard to these claims it is true that such oils are better than either of the types mentioned above as undesirable, but are found to show greater starting load than the dewaxed low-viscosity-change oils. The choice would, therefore, depend on how important the ability to start easily is considered in comparison with price or other considerations.

Flying at high altitudes, under any ground conditions, very low temperatures are encountered. Unless some arrangement is made for maintaining normal oil temperature, the above considerations apply. Such temperatures due to altitude would never occur in ordinary commercial flying, but would be quite common in warfare.

Oiliness

During the World War it was found that some engines then in use could be lubricated with castor oil, but not with mineral oil. Oils and engines have been improved since that time and it is now possible to lubricate all production engines with mineral oil. Oiliness may be defined as that quality of a lubricant which produces a low coefficient of friction when boundary lubrication is obtained. More data is necessary to obtain a complete understanding of the part which oiliness plays in the lubrication of an engine. As long as a thorough distribution of the oil is obtained, other factors are probably more important. It is known that fatty oils have a lower coefficient of friction than mineral oils and, in view of the great difference possible in chemical composition, it seems that mineral oils may vary considerably in oiliness. If trouble is found which is due to lack of sufficient lubrication, it might be overcome by the use of castor oil or of a blend of a soluble fatty oil or free fatty acid with mineral oil. It is believed that a redesign of the oiling system would be a better solution.

Miscellaneous

Wax content: Aside from the effect on distribution in cold weather, no tests are known which indicate wax to be detrimental. Tests made by the Air Corps indicate no difference in life in an engine when wax is added to a dewaxed oil.

Oil base: The results of tests indicate that both good and poor oils are made from both paraffin-base and naphthene-base crudes.

Oil changes: The cost of the oil is a very minor part of the expenses of operating an airplane. The use of a poor oil or a good oil for too long a time is likely to result in more expense than savings. The Air Corps at present changes oil at 20 hours, which is rather conservative. With high quality oils 30 hours is suggested as a safe and economical use. In this connection it is of interest that Liberty engines with an oil consumption of approximately one gallon per hour have been operated from 80 to 100 hours without changing oil. After the first 15 to 30 hours there is little or no change in the oil, the new oil added keeping the condition in equilibrium.

Dilution: Dilution is not an important factor in airplane engines. The amount of dilution rarely exceeds 2 per cent.

Reclaimed Oils: Reclaiming is better than using the oil for a longer time without reclaiming. The statement is frequently made that reclaimed oil is better than new oil. While the Air Corps has used large quantities of oil reclaimed by two distinct processes without any noticeable difficulty, some recent tests cast serious doubts on the quality of the oil. If the reclaiming process re-refines the oil, restoring or bettering the original tests, including color, neutrality and carbon residue, and removes all tarry compounds, it is considered quite likely that the reclaimed oil would be better than the original. By merely evaporating the dilution and filtering or emulsifying out the solid impurities, the oil is restored for service but is not considered equal to the original.

References: Reference is made throughout this paper to U. S. Army Air Corps laboratories. Most of the ideas presented have been obtained from tests at McCook Field and later at Wright Field or from standard Air Corps procedures.

Photomicrograph (Magnified about 70 diameters).

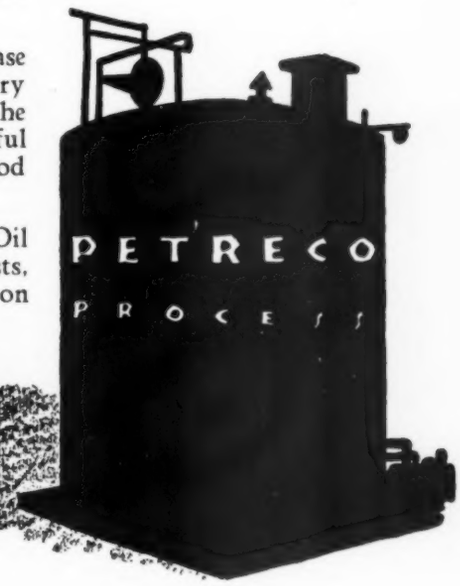
Just a tiny drop of oil — that's all!

Analysis of this gas blown crude of 25.8° gravity A. P. I. shows a total cut of 12.4% (water 0.1%, emulsion 12.3%). An extremely fine emulsion with a predominating size of .0002-inch.

"Petreco" engineers and technicians took this case in hand and determined by analysis and laboratory tests what results could be obtained, and how. The "Petreco" method of treatment was proved successful in advance, and the "Petreco" installation made good in every detail.

When you encounter "cut oil" let your Official Oil Doctor determine the best method of treatment, costs, results, etc., in advance. Complete information on request.

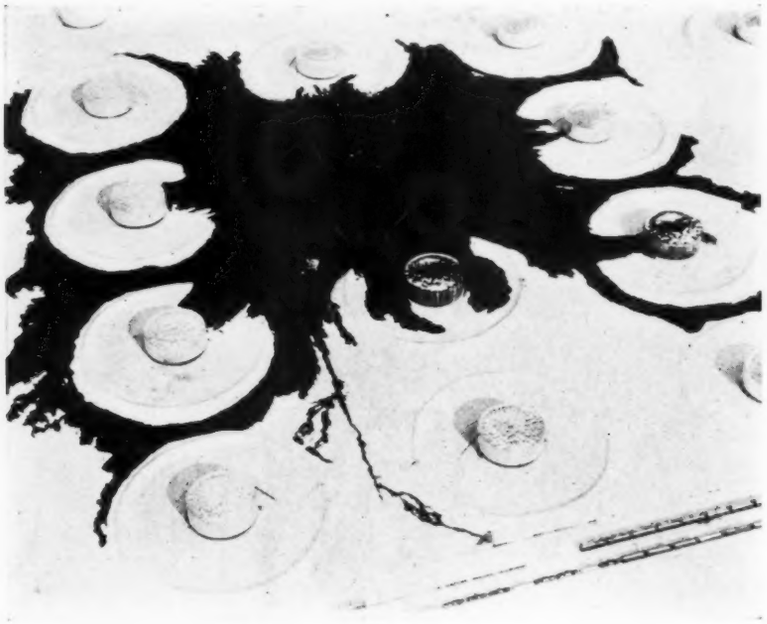
Fully covered by process and apparatus patents.

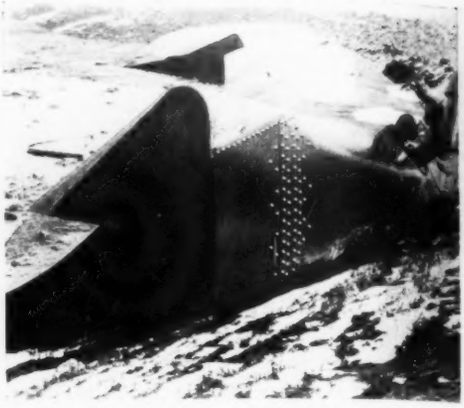


PETROLEUM RECTIFYING COMPANY of CALIFORNIA

Security Title Insurance Bldg. Los Angeles, Calif.

530 West 6th Street, Petroleum Bldg. Houston, Texas





Left — Airplane view of the tank farm; black is oil which has flowed from damaged tank over the snow.

Above—Close-up of the tank.

Airplane Views of

Flooded Tank Farm

FROM a casual glance the two large pictures accompanying this story might be mistaken for a group of caterer's cakes at a banquet table over which some enthusiastic guest has accidentally spilled the coffee. Instead, however, they are airplane pictures of a broken oil tank.

The pictures show two rather unusual conditions—Oklahoma covered with a blanket of snow, and a large 80,000-barrel-capacity tank which has collapsed.

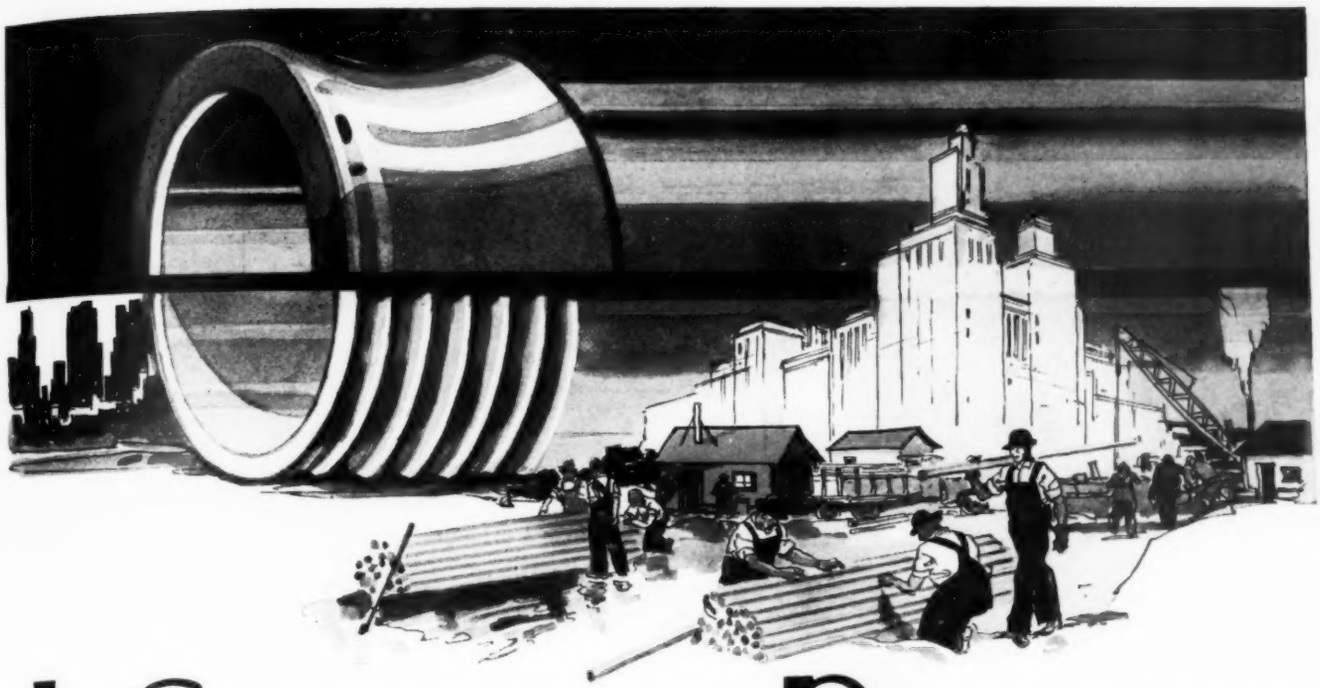
They were taken during a flight over the large oil tank farm of the Continental Oil Co. near its refinery and main office at Ponca City, Okla. During a snowstorm which occurred last winter, one of the large tanks on the farm collapsed. The oil from this tank rapidly spread over the adjoining ground. Reaching the fire banks of adjacent tanks, it flowed over them and even splashed the white paint of some of the tanks.

In the upper left picture the damaged tank is invisible, being submerged in a sea of oil, and in the lower right picture the oil has subsided sufficiently to permit the outline of the tank to be visible. The two smaller pictures show close-up views of the damaged tank.

An idea of the altitude may be gained when it is noted that the two parallel lines in the upper left picture are freight and tank cars which are spotted on the siding.

Right—Another view of the tanks taken from the air.

Below—Damaged tank after the oil had been reclaimed.



It STANDS *to* REASON

Making pipe to the strictest standards of workmanship is ONLY ONE HALF OF THE JOB of rendering satisfactory service to the pipe user.

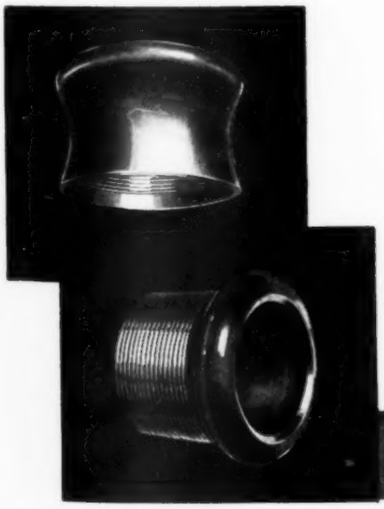
THE BIG THING, equally important, is to ship it to destination without damage to the threaded pipe ends and couplings.

With the advent of the patented COLONA PIPE THREAD PROTECTORS, leading pipe manufacturers are today able to ship their pipe to all parts of the world with the absolute certainty that every length will arrive in the same perfect condition as when it left the mill.

Remember that Colona Thread Protectors SAFEGUARD BOTH THE THREADED PIPE ENDS AND THE COUPLINGS AS WELL. Moreover the ends of the pipe are amply protected against mushrooming by the exclusive lip design of Colona Protectors.

ASSURE YOURSELF of the protective features of Colona by specifying Colona Protected Pipe in your order requisitions.

PITTSBURGH SCREW & BOLT CORP.
COLONA DIVISION **PITTSBURGH, PA.**



COLONA

PIPE THREAD PROTECTORS

When writing COLONA DIVISION PITTSBURGH SCREW & BOLT CORP. *please mention The Petroleum Engineer*

PROCESSES *in* » » » »

Soda Soap Grease Manufacture

By S. J. CAPLAN

SODA soap greases, generally speaking, are characterized by high melting points and a fibrous appearance. They are readily recognized by rubbing a small portion in the palm of the hand with water. In this physical test the appearance of the grease is changed and the water soluble soap that is present is readily seen. In other words, the soda soap greases disintegrate in the presence of water.

These greases vary in appearance from a thick liquid to an exceedingly hard block. They will vary in color from a light golden shade to a pitch black one.

Transmission Grease

Tallow	416 lbs.	Cylinder Oil (247 vis. @ 210° F.)	9526 lbs.
Na OH	58 lbs.		

Saponify the tallow with the caustic soda in a steam-jacketed kettle equipped with heavy stirrers. Use a minimum amount of water for saponification. After the soap has been made, turn on full steam pressure (at least 80 lbs.) and dry out the soap. Keep the paddles constantly going. When the soap begins to bunch up, add slowly about 200 pounds of cylinder oil. In about an hour's time the grease should be very tough and should start climbing up the shafting that carries the paddles. As soon as this condition arises, more cylinder oil is slowly worked into the grease. (At this stage it is important to make certain that the grease is perfectly smooth and free from all lumps. If there are any hard lumps of undissolved soap, the grease must be stirred until these lumps disappear. Under no circumstances should additional oil be added before these lumps disappear.) At no time should there be a considerable quantity of oil floating on the grease. When about 2500 pounds of cylinder oil has been added, the heat is turned off and the balance of the cylinder oil rapidly added. At this stage the hot grease is soft and takes up the oil very rapidly.

This transmission grease is one of the most important and widely used greases. When made a little stifffer than the above formula, it finds wide use as a "roller-bearing grease." The following formula is correct for this purpose:

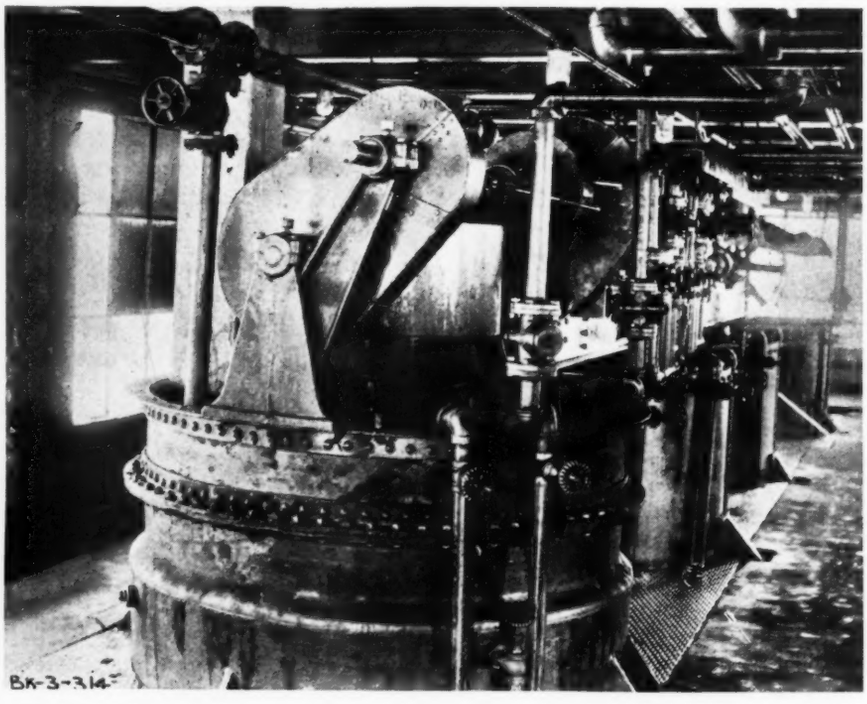
Roller-Bearing Grease

Tallow	539 lbs.
Na OH	75 lbs.
Cylinder Oil (247 v's. @ 210°F.)	9386 lbs.

High-Temperature Lubrication

For the lubrication of cement mills, the following grease has been found satisfactory:

Tallow	3490 lbs.
Na OH	510 lbs.
Cylinder Oil (247 vis. @ 210° F.)	6000 lbs.



Grease kettle in a modern refinery.

Wire-Drawing Grease

Tallow	2330 lbs.	Cylinder Oil (247 vis. @ 210° F.)	7340 lbs.
Na OH	330 lbs.		

The greases mentioned above are black in color. The following formulæ will make the ordinary "fibre greases" or "sponge greases," which are golden in color:

	Soft	Medium	Hard
Tallow	2212	2315	2430
Na OH	332	347	364
Paraffin Oil (100 vis. @ 100° F.)	7523	7407	7279

As mentioned before, the soda soap greases are usually fibrous in appearance. This is true of all of the greases so far mentioned. We now come to the smooth-looking soda soap greases.

Block Greases

These greases are made in a fire kettle equipped with powerful paddles.

Hard Grade

Cocoanut Oil	2330 lbs.	Na OH	780 lbs.
E Rosin	2160 lbs.	Filtered Cylinder Stock	4730 lbs.

Saponify the cocoanut oil and rosin with the caustic soda and then evaporate the water almost completely. Add the oil. Heat to 225° C. and then run into pans 5 inches deep.

Soft Grade

Cocoanut Oil	1480 lbs.	Cylinder Oil (247 vis. @ 210° F.)	3150 lbs.
E Rosin	1370 lbs.	Refined Montan Wax	500 lbs.
Na OH	495 lbs.		
Filtered Cylinder Stock	3005 lbs.		

This grade is made exactly like the hard grade. If there is any tendency for this grade to separate oil, stir until the grease starts to thicken.

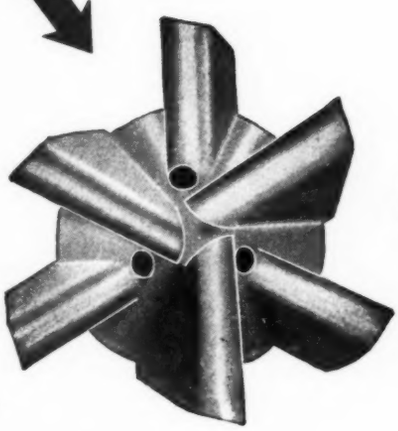
The following soda soap grease is pure white in appearance and is made in a steam-jacketed kettle:

Stamping Compound

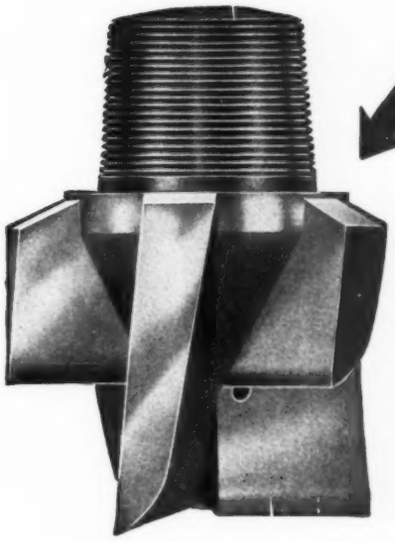
Tallow	2474 lbs.	Water	4717 lbs.
Na OH	335 lbs.	Red Oil	2474 lbs.

The tallow is saponified completely and the red oil then worked in. When the red oil has been completely crutched into the soap, the steam is turned off and the water is added. When all of the water has been added, this product will be a perfectly white, smooth paste. When finished it should be run into packages and immediately headed up. This product has a tendency to "bleed" slightly if it is exposed to the air for a long time. In sealed packages, however, it will stay in perfect shape indefinitely.

The Brewster (AP) Straight Hole Rock Bit



The hard facing of this bit cuts a perfectly round hole in any formation.



Set with Borium

The Brewster A. P. I. Straight Hole Rock Bit is made of high-grade Chrome Nickel Steel, and faced with Borium which is scientifically fused with the steel.

This Bit is primarily designed to cut a straight hole, with pilot blades at bottom and reaming blades above. It will not jump or lead off, as is common with ordinary bits.

Its diamond-like hardness guarantees a full gauge hole. Where the roller bit will not cut broken formation, the Brewster six-way bit will cut both hard and soft, and *insures a perfect straight hole.*

Ask Any Contractor in the Oklahoma City Field

The Brewster
COMPANY~INC.
SUCCESSORS TO OIL CITY IRON WORKS INC.
Shreveport, Louisiana

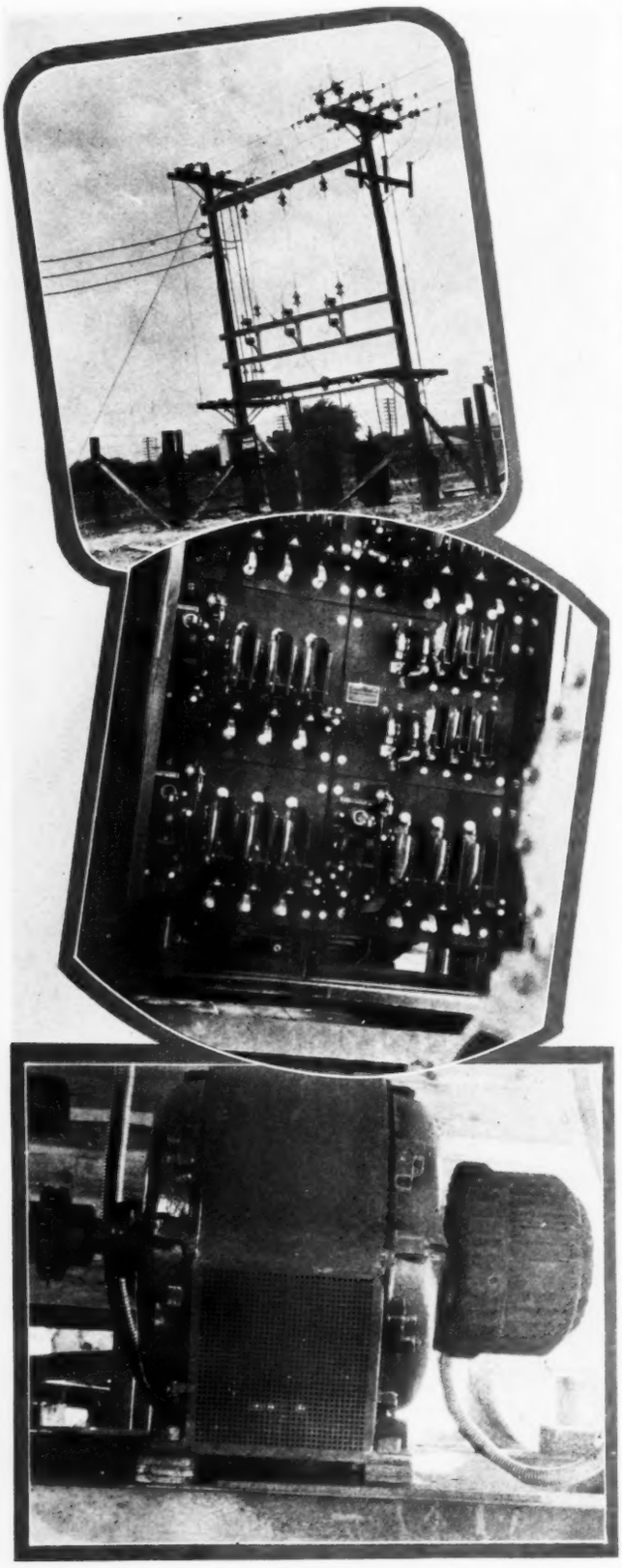
Ask about other Brewster A.P.I. Products

SPECIAL ROCK BITS; Shouldered Tool Joints; Drill Collars; Fish Tail and Special Gumbo Bits; Core Barrel Cutter Heads for both soft and hard formations—Cutter Heads for hard formations are faced with a substance of diamond-like hardness.

COMPLETE STOCK carried at these warehouses: Iverson Specialty Co., Oklahoma City, phone 22833; Houston Store, 2000 Harrington St., phone Capitol 3021. **Distributors:** Wilson Supply Co., Houston, Beaumont and Luling, Texas; Continental Supply Co., all stores; Murray-Brooks Hardware Co., Lake Charles, Louisiana; T. T. Word Supply Co., Houston, Texas, and Lake Charles, Louisiana; The Ellis Iron Works, Inc., El Dorado, Arkansas. **Exclusive Export Agents:** The W-K-M Co., 74 Trinity Place, New York, N. Y.

WELLS DRILLED WITH » » »

Electrically Operated Drilling Units



Top to bottom—Electric transformers, used at every electric rig. Secondary control panel of the rotary drilling control. Electric drilling motor that is driving a slush pump at Oklahoma City.

THE first extensive use of electric motors as a means of operating rotary drilling units is occurring in the north end of the Oklahoma City field.

Three wells have already been completed which employed electricity as power. At the present time there are ten wells being drilled with electric current, while probably half this number are expected to be installed in the near future, and many others may also make their appearance.

Hall and Briscoe are the pioneer users of electric motors for drilling power in the Oklahoma City field. This company completed the first electrically drilled well. At the present time it has three electrical drilling installations and plans for starting others.

The past two years have seen a marked change in the design and construction of electrical drilling equipment. The increasing practice of using the rotary for the entire hole has resulted in larger and more powerful motors and changes in design and general construction.

Since the inception of the electric drilling motor at Oklahoma City by Hall and Briscoe early in 1929, there has followed a steady development of the motors. The early electrical drilling installation in the field had a 150-horsepower motor. Several of these are still in use, but several newly designed motors of larger horsepower are now in use.

Among these is an 250-85 horsepower motor, the largest for electric drilling yet placed in the oil fields. It has several features that improve its efficiency. The motor has a welded steel yoke cover. The large range of power offered by its dual cycles or rigging, is practically the same as two motors, being so consructed that it is not necessary to operate the full 250 horsepower when this much power is not needed. Thus, only 85 horsepower will take care of the rotating, while for hoisting the 250 horsepower connection is used. Tests have shown that 600 horsepower may be developed, allowing 10 per cent for slippage.

The motor develops 705 revolutions per minute at full load. It has a very fast rope speed. At high speed it has a rope travel of 1330 feet per minute, 837 feet per minute in intermediate speed and 408 feet a minute in low speed.

The usual electric installation at Oklahoma City has three electric motors. One is used to operate the draw works, one is used to each slush pump of which ordinarily there are two. A twenty-two tooth drive sprocket is used and a 30-tooth line sprocket. The draw works are operated from the motor by means of a flexible coupling connection to a gear unit which turns the draw works line shaft by means of a standard rotary chain running over a sprocket on the low speed shaft of the gear unit. A reduction gear ratio of 3.29 to 1 is obtained.

The control boards are located back of the draw works under the housing. The main controller reverses the motor as well as regulates the speed, but does not carry the primary current.

Electrical current is easily available in the Oklahoma City field due to its closeness to the city. In the north end of the field drilling is being done on townsite lots. In one spot in this part of the field a cluster of five electric drilling wells are so closely located that it is but a few steps from one derrick floor to another.

W. C. Bardé, pioneer oil field drilling electrician, formerly with Backon Drilling Company at Earlsboro and now chief electrician for Hall and Briscoe, is greatly interested in the amount of water saved with electric units.

Possibilities of PROFIT Through Utilizing Waste Refinery Gases

By PAUL TRUESDELL*

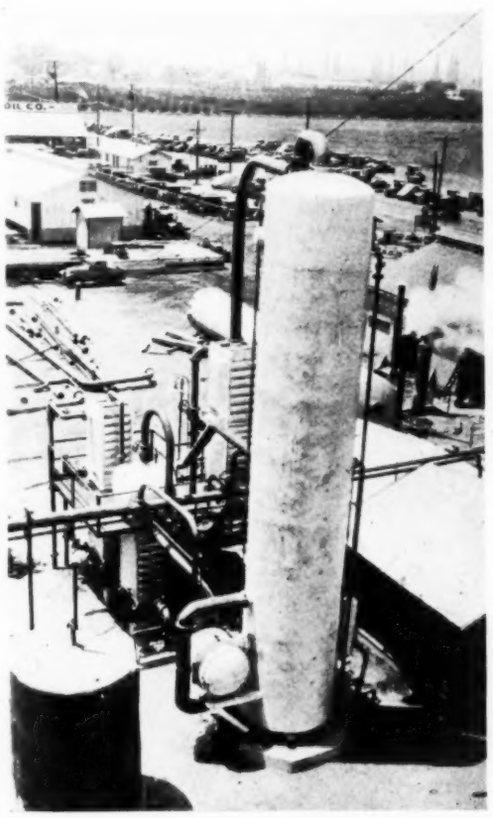
NEW methods of utilizing to better advantage gases generated in the distillation and cracking of petroleum were discussed at the meeting of the American Gas Association in Cleveland, May 21-23.

These methods open the way for the refiner to new profits from by-products which hitherto have been largely wasted or applied to uneconomic purposes—that is, refinery gases.

Realization to the fullest extent of the possibilities and benefits lying just ahead will call for a new measure of cooperation between the oil refining and the gas manufacturing industries, it was pointed out.

Two chief methods were set forth for the better utilization of refinery gases. One was the so-called "reforming" of refinery gases, which is thus described by Dr. Gustav Egloff of Universal Oil Products Co.:

"The 'reforming' of hydrocarbon gas is accomplished by cracking, so as to produce two or more volumes of gas having a lower Btu content per cubic foot than the original gases converted. In the 'reforming' process the cracking reaction produces a large volume of hydrogen having a low Btu content per cubic foot. Inasmuch as the refinery gas contains from 1200 to 2000 Btu per cubic foot, and the usual legal requirement of towns and cities is 530 Btu per cubic foot, the effect of 'reforming' is to dilute the gas to the legal Btu standard, at the same time greatly multiplying its volume."



One of the Wilshire Oil Co.'s gasoline plants in California.

The other method proposed was the distribution in liquid form of propane and butane for heating and refrigerating purposes. The time is probably not far distant, it was suggested, when propane and butane from the refinery and natural gasoline plants will be generally distributed for heating and refrigerating purposes.

The distribution will probably be in liquid rather than gaseous form, and the materials will be transported in tank cars and tank trucks as gasoline is now. The gas companies with their wide public contact and service facilities, it was predicted, will handle the delivery of the gases to the consumer.

Dr. Egloff, under the title, "The Cracking of Heavy Oils and Tars," emphasized the importance of the cracking process, not only as a provider of gasoline, but also as a factor in the gas supply.

He pointed out that the total quantity of gas produced in refineries as by-products of distillation and cracking operations exceeds the volume of manufactured gas made in the United States. Not only this, but the Btu content of the refinery gas is more than double that of the manufactured gas.

Dr. Egloff also called attention to the rapidly-increasing use of gas for fuel. He expressed the opinion that gas consumption will grow tremendously, thus greatly widening the possibilities for marketing refinery gas at a profit.

Perhaps the most interesting proposition put forward at the meeting was that of H. Janney Nichols, Jr., of the Standard Oil Company of New Jersey, under the title, "Relationships Between the Petroleum and Gas Industries."

Mr. Nichols questioned whether propane and butane have reached their highest usefulness when used for enrichment of water gases for "reforming" and for cooking in suburban and country homes. He proposes what he believes more advantageous use of these gases as follows:

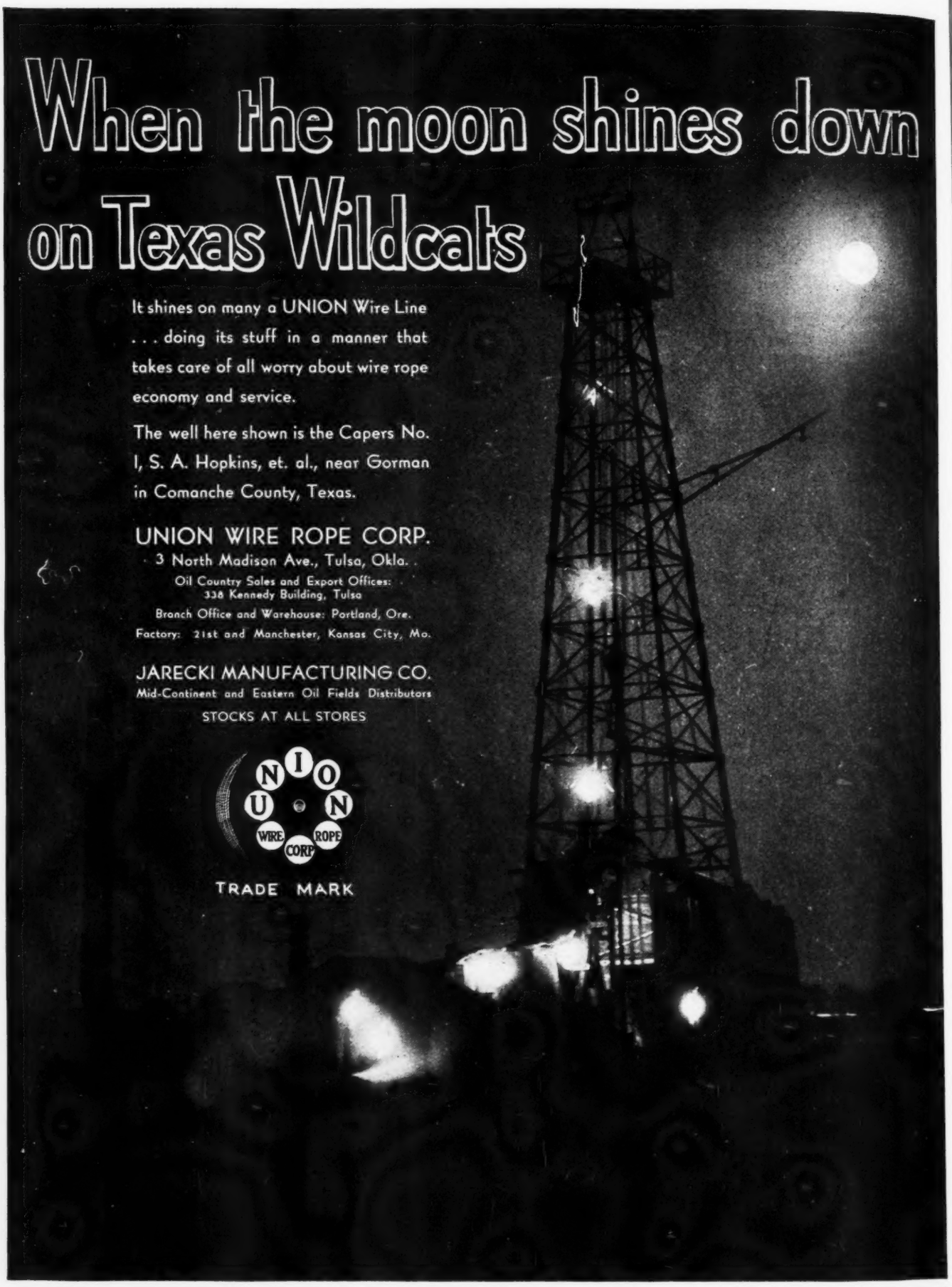
"It would seem that a much larger outlet for these liquid gases is in industrial plants where fuel is required in gaseous form. To such plants propane and butanes may be delivered by tank cars as a liquid. One cubic foot of liquid propane when vaporized at standard conditions becomes 277 cubic feet of propane gas. Why vaporize this one cubic foot of liquid into your gas holder as 277 cubic feet of gas for enriching purposes, or as 900 to 1300 feet of a reformed gas?

"You know quite definitely what gas of 530 Btu costs in the holder. If this cost be 30 cents per 1000 cubic feet, then one gallon of propane, in the holder, is worth only 5.3 cents on a Btu basis. Gas is sold by volume, but since the Btu value is very definitely set, the gas industry is actually selling heat units. From this it follows that a gallon of propane used for enriching purposes is worth to the gas industry only what it costs to get 93,000 Btu in your holder.

"To reform this gallon of propane is only confusing the issue by spreading out the same number of heat units in an even larger volume of gas than by merely vaporizing

* Universal Oil Products Company, Chicago, Illinois.

When the moon shines down on Texas Wildcats



It shines on many a UNION Wire Line . . . doing its stuff in a manner that takes care of all worry about wire rope economy and service.

The well here shown is the Capers No. 1, S. A. Hopkins, et. al., near Gorman in Comanche County, Texas.

UNION WIRE ROPE CORP.
3 North Madison Ave., Tulsa, Okla.
Oil Country Sales and Export Offices:
338 Kennedy Building, Tulsa
Branch Office and Warehouse: Portland, Ore.
Factory: 21st and Manchester, Kansas City, Mo.

JARECKI MANUFACTURING CO.
Mid-Continent and Eastern Oil Fields Distributors
STOCKS AT ALL STORES

UNION WIRE ROPE CORP

TRADE MARK

UNION WIRE LINES

When writing Union Wire Rope Corp. *please mention The Petroleum Engineer*

it. Once this gallon of propane becomes a gas in the holder, it must be distributed through a pipe line system to the ultimate consumer, and if this be a low-pressure distribution system (5 pounds or less), this one gallon of propane or 93,000 Btu will occupy a space approximately 200-1000 times the space it would occupy as a liquid.

"If it be kept in the liquid state, it may be marketed by tank cars wherever there are railroads and tank trucks wherever there are good roads.

"This becomes a simple question. Is it cheaper to deliver one cubic foot of liquid by tank car or 277 cubic feet of gas by pipe line to get the same number of Btu to the ultimate consumer? Any saving in favor of the delivery of liquid propane adds to its value as a gas in the holder."

Mr. Nichols pointed out also that propane is ideal both as fuel and as a refrigerating medium for dining cars and similar uses.

Concerning the method of delivering these products to the ultimate consumer, Mr. Nichols said:

"The petroleum industry markets its product principally in bulk. Where these products are retailed, it is done on the cash and carry plan.

"The gas industry is essentially a retail business, in which the gas companies distribute their product to the individual consumer, read meters, submit bills and collect them. It would therefore seem logical for the petroleum industry to continue to produce and ship propane and butane in bulk, and for the gas industry to retail these liquid gases to the ultimate consumer. You have the organization for retailing this business; the petroleum industry has not. If these products be put to the purpose for which they are peculiarly adapted, there is a profit for both industries.

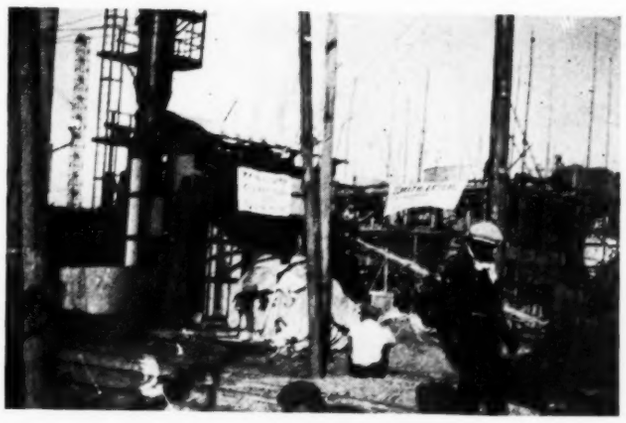
"The cracking units which are now in operation in this country are a potential source of 900 million gallons of propane per year. The heating value of this quantity of propane is equivalent to 80 trillion Btu, or about 30 per cent of the manufactured gas industry of today. The volume of available butane is equal to that of propane, or even greater.

"Since the gasoline from cracking today is seven times what it was ten years ago, the potential source of propanes and butanes from cracking alone in another ten years may be four to five times the heating value of the total manufactured gas industry of today.

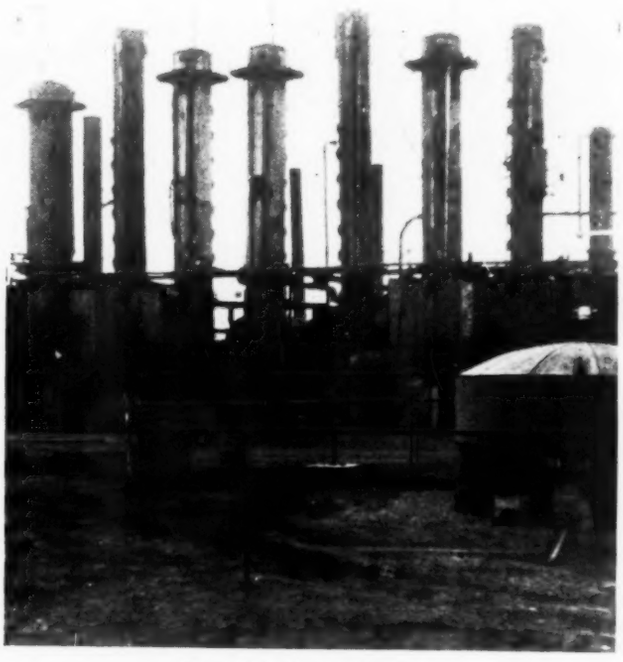
"In addition, Mr. Oberfell of the Phillips Petroleum Company estimates that there are 13 million gallons of propanes and butanes per day available from the natural gasoline industry. This is the equivalent of 430 trillion Btu per year, or about 1½ times the total produced by the manufactured gas industry."

"The Economies of Reforming Refinery Gases" was discussed by C. A. Schlegel, United Engineers and Constructors, Inc., Philadelphia, Pa., and

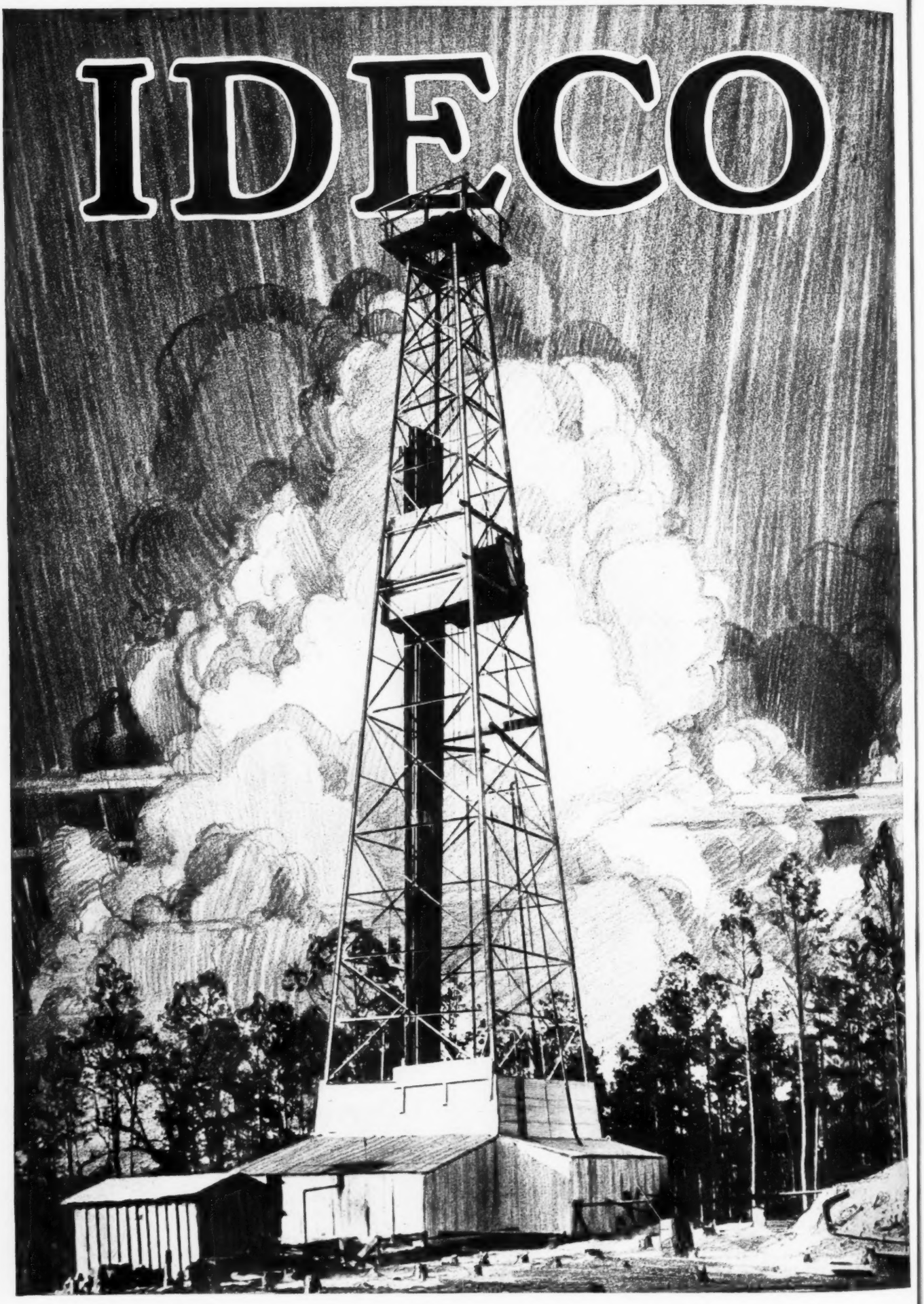
"The Refinery Gas Reforming Plant at Chester, Pa.," by R. G. Rincliffe of the Philadelphia Electric Company.



A refinery under construction in Japan.



Scene in a Texas refinery.



When writing INTERNATIONAL DERRICK & EQUIPMENT CO. *please mention The Petroleum Engineer*

The reason for IDECO stability

RESEARCH, experiments, and years of usage in the oil fields of the world have combined to produce IDECO derricks of the highest possible working efficiency. Incorporating strength, rigidity, a minimum number of parts, a variety of sizes and weights for every type and class of drilling or pumping use, and performing all classes of work under the most severe conditions, IDECO Structural Steel Derricks are unequalled and have never been successfully imitated.

The builders of IDECO derricks are steel men. They know steel, its possibilities and superiority. Years of actual experience in structural design are built into IDECO Derricks.

THE INTERNATIONAL DERRICK & EQUIPMENT CO.

Columbus, Ohio Marietta, Beaumont, Texas Los Angeles, California

Plants: Columbus, Delaware, Ohio; Torrance, California; Beaumont, Houston, Texas. District Offices: New York City, N. Y.; Pittsburgh, Pennsylvania; Wichita, Kansas; Tulsa, Oklahoma; Shreveport, Louisiana; Ft. Worth, Beaumont, Texas; Maracaibo, Venezuela. Warehouse and Stocks: Columbus, Delaware, Ohio; Seminole, Tonkawa, Drumright, Okemah, Maud, Sasakwa, Allen, Oklahoma City, Oklahoma; El Dorado Wichita Heights McPherson, Kansas; Houston, Beaumont, Big Spring, Odessa, Pyote, Pampa, Borger, Mexia, Luling, Wichita Falls, Grand Saline, Seguin, Hebbronville, Texas; Lake Charles, Shreveport, Zwolle, Louisiana; Smackover, El Dorado, Arkansas; Bakersfield, Taft, Torrance, California; Hobbs, New Mexico.

Export Offices: 90 West Street, New York City; Columbus, Ohio; Houston, Texas; Los Angeles, California. 504-R

When writing INTERNATIONAL DERRICK & EQUIPMENT CO. *please mention The Petroleum Engineer*

From the 4th to 11th of next October, the world-wide petroleum industry will center at the International Petroleum Exposition and Congress in Tulsa. Men from every country where oil is found will again meet at this great international market of petroleum equipment. The most important associations within the industry will meet in the Exposition auditorium during this period.

In an enlarged Exposition plant, with more space, more buildings and better facilities than ever before, there will again be demonstrated the very newest developments in methods and machinery for prospecting, producing, refining, transporting and marketing petroleum and its products.

Plan NOW to attend. For any information, address Wm. B. Way, Gen. Mgr., International Petroleum Exposition, Tulsa, Okla., U. S. A.

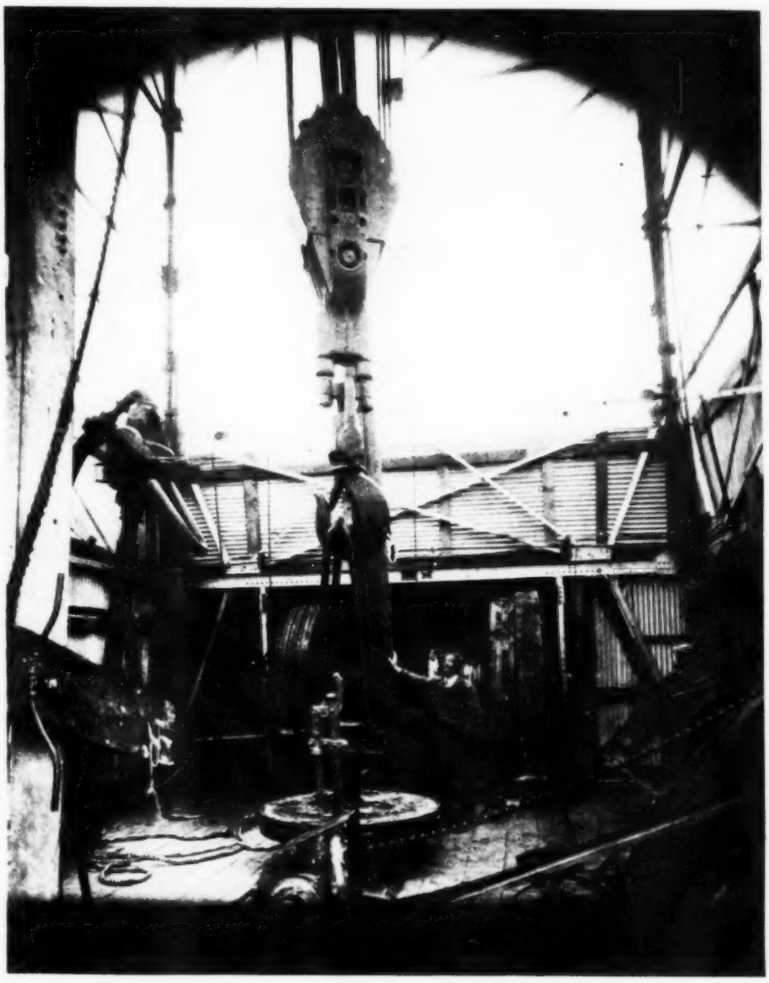
Rotary Drill Units Show Marked Improvements

By WARREN L. BAKER

THE past five years have seen a marked trend toward deeper drilling. Along with this development came the demand from operators for drilling equipment capable of penetrating the greater depths with more reliability, safety and speed. A more general adoption of the rotary drill in the early days of this trend resulted.

Since this adoption of the rotary drill, tremendous strides have been made by the engineers of the manufacturing companies in perfecting and improving the older type of rotary units. Perhaps more important has been the many new designs and principles that were introduced.

The rotaries used in the development period of the Greater Seminole field during 1926 and 1927 were the best of that time, but are in marked contrast to the rotary machines used in the field today. Every unit of the rotary machine has been greatly changed since that time, and we have witnessed the greatest mechanical advancement of any particular phase of the oil business. The general trend in rotary equipment has been toward the bigger, heavier, all-enclosed, all roller-bearing units. This remarkable advancement is by no means ended. Each day new improvements and designs are heard of, and the next few years will probably see as many changes as the past few years have recorded.



Heavy combination rotary-cable tool outfit used in West Texas.

All of the equipment going together to make the complete rotary drilling unit is forged and assembled with the same delicate precision of the finest mechanical engines of today. The fine service given by many of the units under the hardest kind of field usage, which is very abusive under the best of conditions, is a credit to the engineers, machinists and manufacturing companies.

When the big competitive drilling campaign of Seminole first got under way the old 10x10 open type twin-cylinder engine was just giving way to the 12x12 twin-cylinder engine, partly enclosed. Since that time the new 12x12 twin-cylinder steam engine, entirely enclosed to eliminate all dust and other foreign particles from the lubricating oil and cylinders, and all roller bearing, has entered the drilling field.

One very recent development in the rotary engine field has been the gas engine. A real engineering feat has been accomplished in these engines by constructing one that will build up exceptional horsepower in a light-weight unit. The average horsepower is 300 in an engine weighing a little less than 15,000 pounds. These are usually of 7¾-inch bore with an 8½-inch stroke.

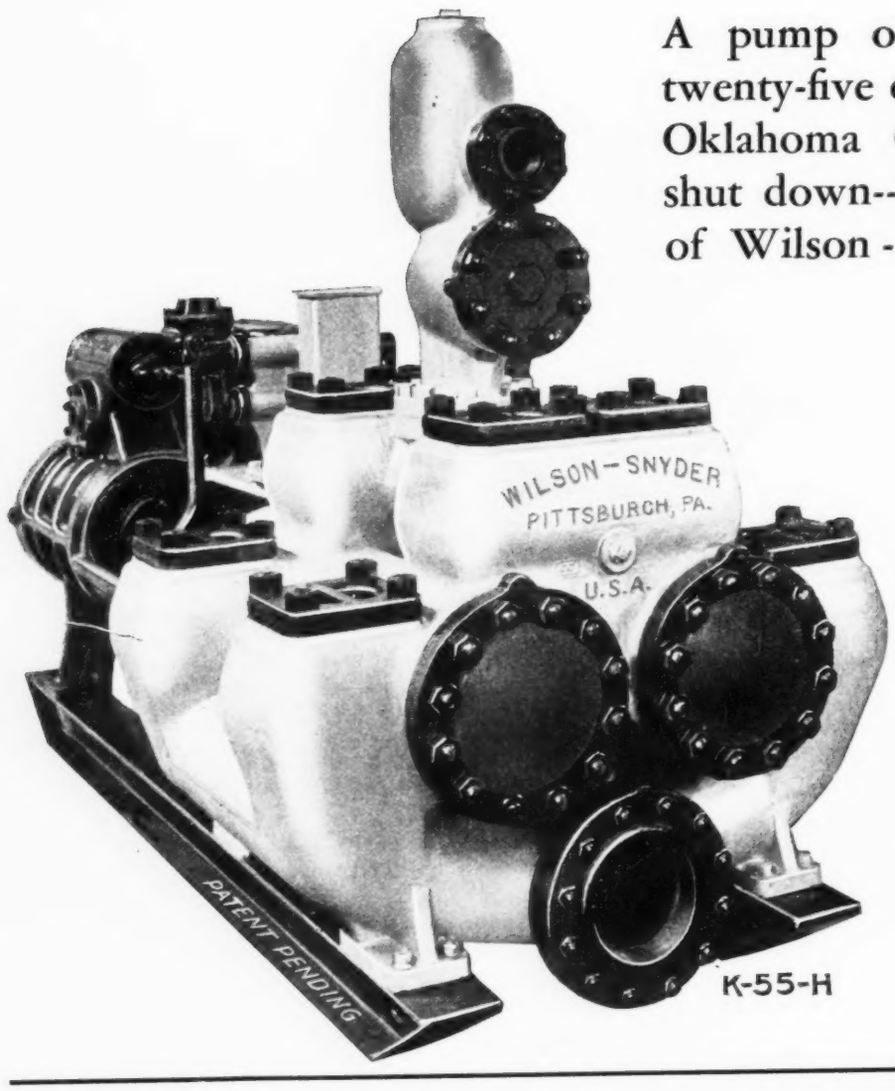
Drawworks have shown a marked advancement from the two- and three-speed, two-shaft, three-post variety to the three- and four-speed, three-shaft, all roller-bearing, two-post drawworks now found in the oil fields. Another advancement adopted by some companies has been the horizontal drawworks. The horizontal position prevents the lagging of the chain on the sprocket at the pulling point, thus saving much power and slippage. These units weigh up to 20,000 pounds and more. Another feature of the drawworks has been the increase made in the drum shafts. This has increased within the past few years from 16 and 18 diameter to 24 and 26 diameter. The increased face has given longer life to the wire ropes.

The old 12x6¾x12 and 12x6¾x14 pumps have been replaced by much larger ones that are built to combat the greater pressures found in deeper drilling. Only two years ago the pumps were 14x7¼x14, having a weight of 11,000 pounds. The slush pumps of today weigh in the neighborhood of 15,000 pounds and are 14½x7½x18, or larger. Some of the manufacturers are now making 15x7¾x18 pumps, while a few manufacturers have a 20-inch stroke pump. Although the general size of the suction has remained at 8-inch, one manufacturer has a 10-inch suction pump on the market. Most of the pumps withstand a pressure of 1500 pounds or more, with a steam end for 350 pounds pressure.

Now!

Your Dependable Offers Two 18" Heavy Duty

A pump of this model ran for twenty-five consecutive days in the Oklahoma City field, without a shut down---Just another example of Wilson - Snyder dependability.



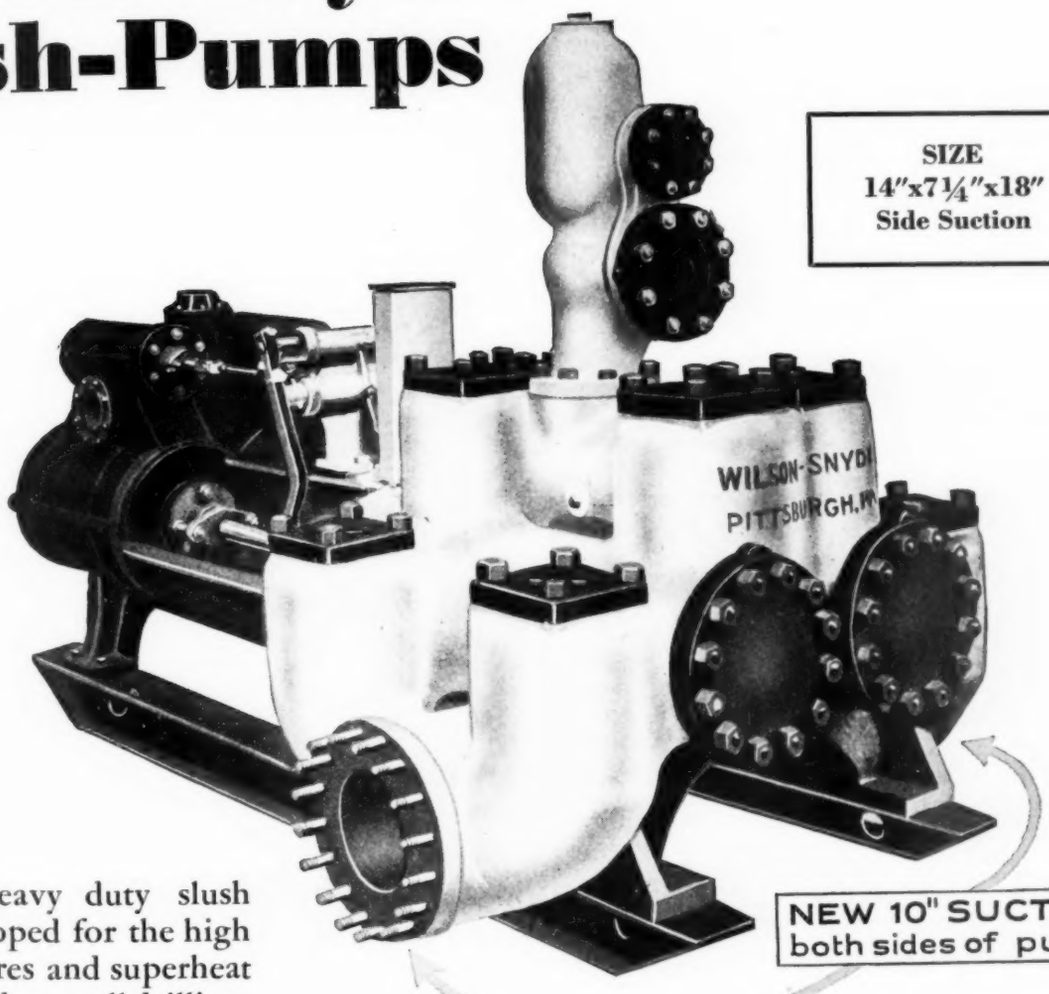
SIZE
14"x7"x18"
End Suction

Distributors of HYDRIL ROTARY EQUIPMENT

When writing MURRAY TOOL & SUPPLY COMPANY *please mention The Petroleum Engineer*

Source of Supply Wilson-Snyder Slush-Pumps

SIZE
14″x7¼″x18″
Side Suction



A greater heavy duty slush pump, developed for the high steam pressures and superheat required for deep well drilling.

NEW 10" SUCTION
both sides of pump

Universal Wire Rope,
Eureka Burners,

MURRAY TOOL & SUPPLY COMPANY
CLEVELAND, OKLAHOMA

Rainbow Rotary Hose,
B-J Equipment,
Hughes Equipment

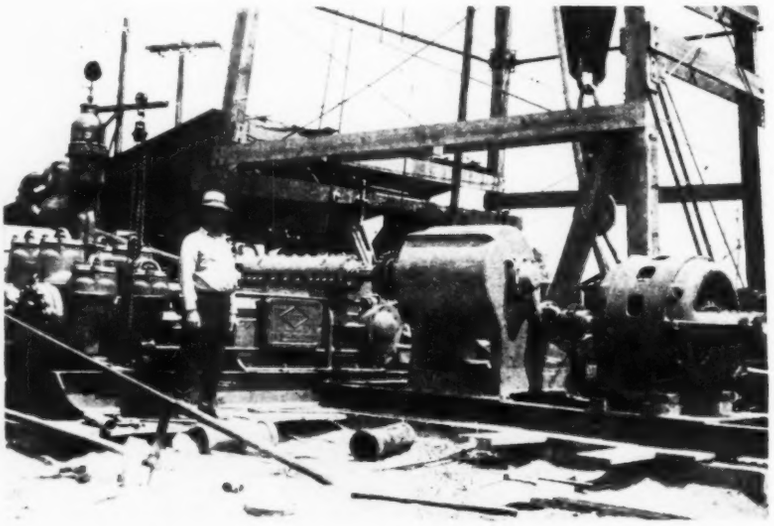
STORES AT

Oklahoma City	Pawhuska	Seminole	Tulsa	Yale	Pampa, Texas	Wichita Heights, Kansas	Hobbs,
Phone 3-7736	Phone 867	Phone 119	Phone 4-0144	Phone 55	Phone 894	Phone 4-3854	New Mexico

When writing MURRAY TOOL & SUPPLY COMPANY *please mention The Petroleum Engineer*

The rotary table has come in for its share of changes. The weight has been increased from around 6,500 pounds to 8,500 pounds. The construction has been improved and changed. All tables are now totally enclosed, all roller bearing, while a popular type is the oil bath design.

Some crown blocks are now of the double deck type, made of manganese steel in place of carbon steel. Most traveling blocks are also made of manganese steel. They are generally four or five sheave, with greater depths in the grooves. The swivel, formerly a two-bearing one, has been changed to three and four bearings, with a thrust bearing at the top and one or two line bearings beneath. The five- and six-inch hooks have been replaced by the nine-inch hooks.

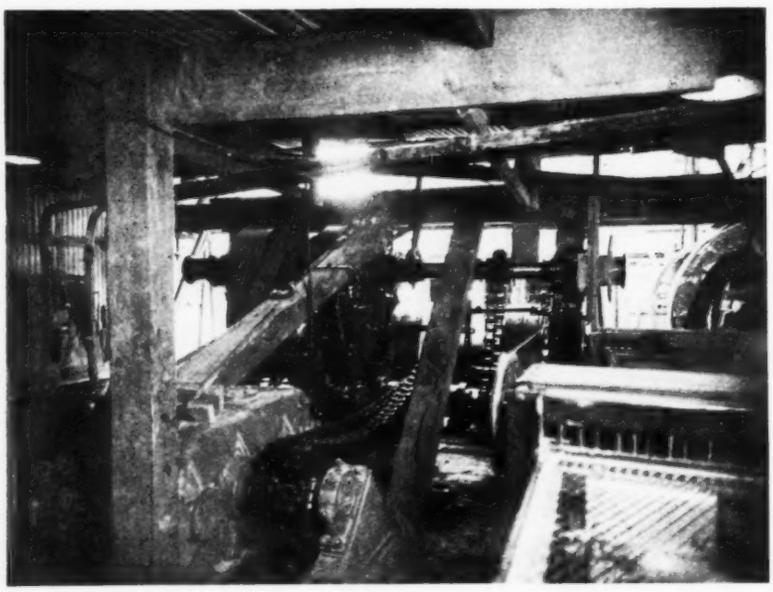


Power pump and gear box for heavy-duty rotary work.

The oil field boilers are constructed of high quality material that must be able to withstand certain chemical and physical tests. A greater degree of safety is also demanded. The boiler found in the oil fields today is usually a 125-horsepower one with a working pressure of 325 pounds, with some rating as high as 350 pounds working pressure. These have replaced the old 70-horsepower boiler with 175 pounds of steam as the working pressure and the 100-horsepower boiler with a working pressure of 200 pounds.

A real innovation in the construction and design of oil field boilers has been the super-heater type boiler. These are becoming quite common. It is principally a reheating of the steam already generated. This gives a dry steam which has a greater working force with less pressure than the saturated steam.

A new entry in the heavy drilling field has been a hydraulic shaft-driven unit. It differs from the usual rotary principle in that it is constructed for hydraulic support of the drill pipe. Pressure can be decreased or increased by the simple operation of certain control valves. The drive from the prime mover to the direct mover is direct through a shaft and gears instead of the usual chains. It has three rotational speeds. Very large, heavy steam cylinder motors drive the unit.



Motor-driven rig in West Texas.

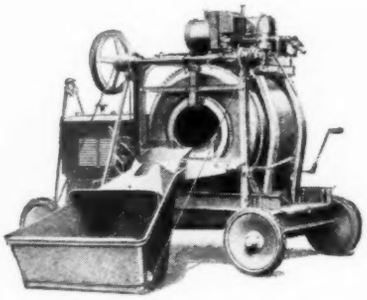
Electrical equipment for running rotary drilling units has been in the field for the past three years, although until recently it had a comparatively limited use. These, like other power plants, have been made larger. Electric motors are being used to drive the drilling units, slush pumps, pipe line engines and pumping equipment in the field. The engines are twin motor reduction gear type that develop large horsepower. Deeper drilling has resulted from encountering greater pressures, which at times have given trouble in controlling. Several devices have been developed for controlling these high-pressure wells. Some of them are in the nature of blow-out preventers, while others are heavy-duty control gates. In fields like the Oklahoma City field, where pressures sometimes run up to 2,300 pounds per square inch, these pieces of equipment are becoming regular standards. All of them permit drilling in the hole while they are in place and offer a ready means of shutting in the well.

Another late development in the drilling field has been that of drill stabilizers. These are generally of hard rubber made to fit around the drill stem, immediately above the drill. They offer a means of maintaining vertical alignment of the drilling string below the casing and reduce a great amount of vibration and corkscrewing.

Weight indicators for drilling wells have made their appearance, and are generally adopted by all of the larger drilling contractors and companies of the Mid-Continent at this time. These indicate and record the actual weight in pounds at all times, check formations being drilled and compile a complete office record of drilling. They have proven more or less indispensable to the driller. If the bit is being forced too hard the indicated pressure is reduced; if the bit is stuck and is pulled the gauge hand goes up. Drillers use it as a guidance for proper weight on the bit.

A great deal of attention is now paid to the condition of rotary mud fluid, especially in the deeper areas with big pressures. It has become necessary in many fields to increase the weight of the drilling mud, so that the well might be controlled while drilling. Several materials have been developed to attain this end.

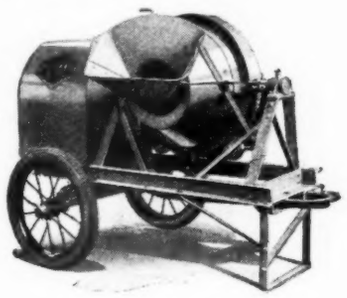
For every concrete job in the oil field



Koehring Dandie Mixer

THE famous Koehring Dandie — handy, long-service quality mixer. Worm gear drive enclosed in oil bath, charging skip low enough for wheelbarrows without runway! Folding steel platform, wide batch hopper, hoist! Batchmeter, automatic water measuring tank.

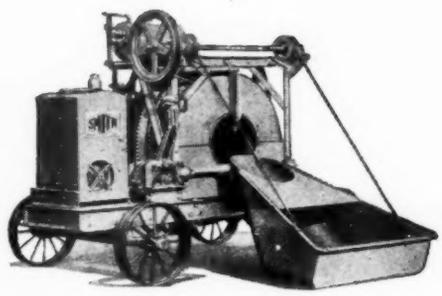
Write for Dandie catalog.



Smith Tilting Mixer

SHORT swing of drum means fast discharge! Big wide charging hopper, only waist-high, saves your back and means fast charging. Smith end-to-center mixing action delivers uniform quality concrete! 3½-S may be equipped with power charging-skip, steel or rubber tires; water tank.

Smith Non-Tilting Mixer



BIG liberal drum openings permit wide skip throats and wide discharge chutes which means fast charging and discharging! Wide, roomy high-speed charging skip! *Paver type* — drum crosswise of frame, and distributing spout! Automatic water measuring tank! Auxiliary water pump when city system is unavailable! Wide feed chute or power charging-skip! Steel wheels or rubber tires! Ask N. E. C. for Smith Non-tilting Mixer Catalog.

Every type and capacity mixer in N.E.C. lines — from the smaller capacities on this page to the great Heavy Duty Koehrings and Smiths.

The N. E. C. lines offer the right mixer for any job, great or small, and include the Weigh-Mix which proportions aggregates by *weight!*

National N.E.C. service behind every mixer. Write N. E. C. for catalogs!

Address nearest of these three:

Leland Equipment Co.
Archer and Guthrie Sts.
Tulsa, Oklahoma
Telephones: 4-1114—L. D. 10

Alamo Iron Works
Santa Clara and Montana Sts.
San Antonio, Texas
Telephone: Crockett 69

Clark & Burrows, Inc.
3600 Commerce St.
Dallas, Texas
Telephones: 87-2669—L. D. 558

When writing NATIONAL EQUIPMENT CORP. *please mention The Petroleum Engineer* A 5756-1-R

Progress in Vapor Phase Cracking

By C. R. WAGNER*

THE commercial development[1] of vapor phase cracking, by means of which the refiner is able to produce a highly anti-knock fuel from either topped crude or gas oil at a cost not out of line with the cost of gasoline made by liquid phase cracking processes, is steadily progressing in the United States and foreign countries.

The rate of progress in this field may be graphically illustrated by reference to Figures 1, 2, 3 and 4. Figure 1 and Figure 2 show the style of installation employed in the first and second plants built, in which recirculation of flue gas was employed. Figure 3 represents the next step in the picture, where recirculation was abandoned, while in No. 4 is shown a more recent design. It will be noted in this last design that construction costs have been cut as well as operating efficiency increased. In this design the gas oil vapors are preheated quickly to a cracking temperature in small parallel tubes, and these streams of hot gas are then united into one stream where a uniform cracking temperature may be held and just enough heat added to offset the endothermic heat of reaction. By means of this style of converter yields are obtained that are strictly comparable with the small single tube unit[2] previously described. More accurate control of the reaction is possible and furthermore greater flexibility of operation and a considerably higher capacity are obtained.

An idea of the continuity of operation and of unit capacity may be obtained from the following figures taken from a plant running two 500-barrel units. These figures are for the 39 days ending March 11, 1930. These units are charging topped Mid-Continent crude and are producing a light fuel oil of 13 to 14 degrees A. P. I. gravity.

Unit hours operated	1,857
Barrels topped crude charged	55,397
Barrels 430 end point distillate made	20,438
Barrels light recycle stock made	861
Barrels fuel oil made	27,526
Dry gas produced, M cu. ft.	33,146
Gas burned, M cu. ft.	26,254
Oil equivalent of gas burned, barrels	6,313
*Per cent fuel on charge	11.4

(*It should be pointed out that this fuel includes that necessary to do the rerunning and to produce steam enough to run all of the pumps in connection with the process.)

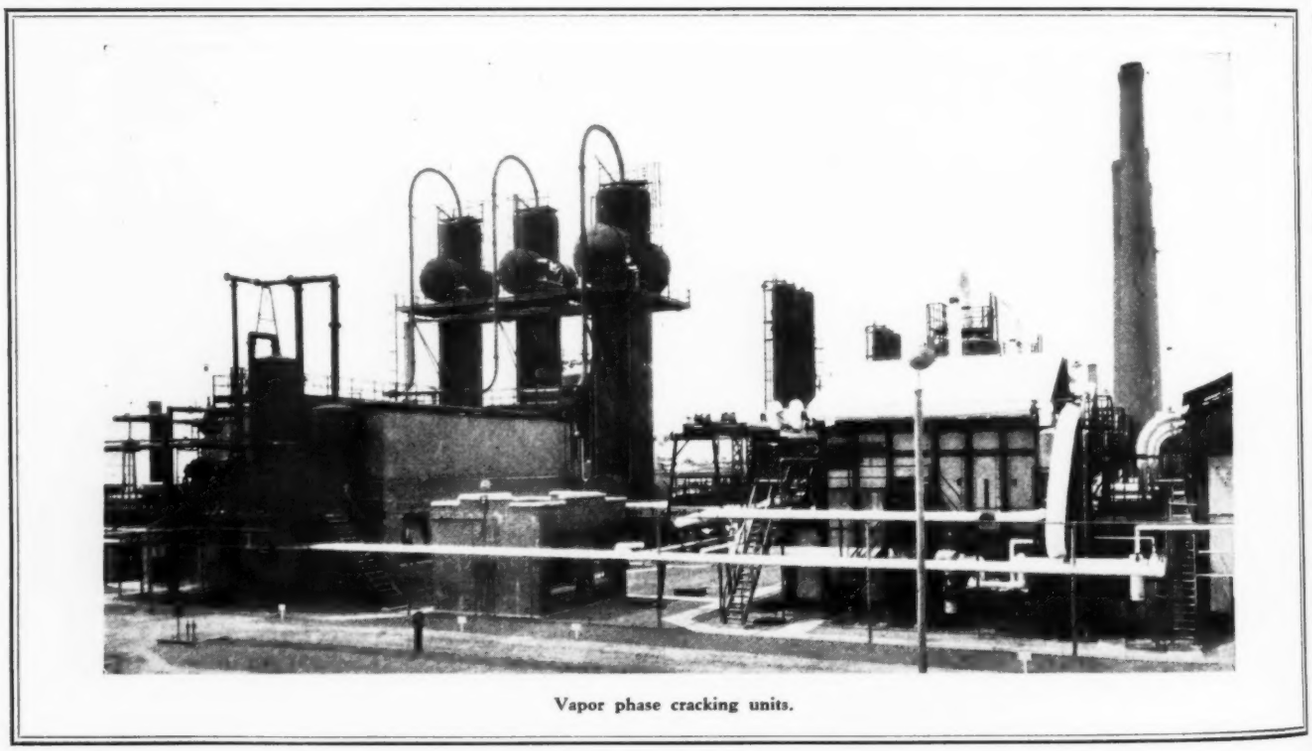
An understanding of the operation of the Gyro Process may be had by reference to the flow sheet shown in Figure 5 and the following explanation:

Owing to the method used in delivering vapors to the converter it is possible to handle any grade of oil as charging stock. Fractions boiling within the range of the motor fuel desired are eliminated at once and by control of the oil line temperature and rate of steam flow into the evaporator as much as or as little of the charging stock as desired may be eliminated as fuel oil. Charging stock from the tank (A) is delivered by means of the pump (B) to the arrester (C) spray nozzles where the vapors leaving the converter (I) are reduced in temperature from about 1,100 degrees F. to 600 degrees F. The liquid and vapors from the arrester pass to the fractionating tower (J). This fractionating tower is so designed that the distillate which is condensed from the vapors leaving the top of it will have a boiling range commensurate with the motor fuel desired. This boiling range is controlled by means of the refluxer

[1] Vapor Phase Cracking, by C. R. Wagner, The Petroleum Engineer, November, 1929.

[2] Principles of Vapor Phase Cracking, by R. C. Osterstrom and C. R. Wagner, Tenth Annual Meeting, A. P. I., December 4, 1929.

* Pure Oil Company.



Vapor phase cracking units.

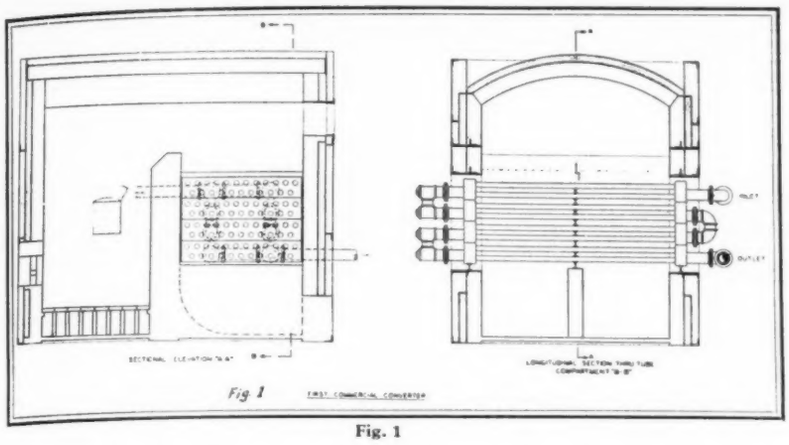


Fig. 1

(O) which may be arranged, as shown on the flow sheet, for the production of low pressure steam. The quantity of steam produced in this manner is more than enough to operate all of the pumps used in the process and to supply all of the required process steam. The gas from the gas separator (L) is led to a compressor for the recovery of its liquefiable motor fuel content by any suitable method.

The hot oil reservoir (D) acts as a collector for all of the oil which enters the system which has not yet been converted into motor fuel or fixed gas. The hot oil pump (E) is controlled as to speed so that it will maintain a constant liquid level in the hot oil reservoir (D). The quantity of this hot oil delivered to the economizer (F) is regulated by an automatic rate of flow controller. This rate of flow is so maintained that the converter is constantly supplied with the correct quantity of vapor. The balance of this hot oil is returned to the charging stock tank (A) through either heat exchangers or coolers.

The portion of the hot oil which passes through the economizer leaves the economizer (F) at a temperature of about 700 degrees Fahrenheit and enters the evaporator (G). Here the fuel oil drops out as a residuum and is removed from the system through the cooling coil (Q) to the fuel oil tank (R). Superheated steam is introduced into the system through perforated coils in the bottom of this evaporator in quantity not to exceed 3 per cent by weight of the vapors produced. The vapors and steam leaving the top of the evaporator pass through separator (H), which removes particles of entrained liquid. From the separator the vapors pass through a series of preheated or drying tubes in the bottom part of the converter (I) to the inlet of the converter. In these drying tubes the vapors are given about 30 to 50 degrees F. superheat, which suffices to remove the white fog that always accompanies any stream of saturated gas oil vapor. These fog particles are in reality tiny drops of liquid oil and unless removed cause some difficulty in the operation of the converter. In passing through the converter the temperature of the vapors is increased to approximately 1,100 degrees F. and the conversion to lighter hydrocarbons occurs at this point. In this converter the vapors are distributed by means of the inlet header and passed through a number of tubes in parallel, the tubes containing catalytic cores. From the outlet of the converter (I) the vapors pass into the arrester (C) which was described above.

It is seen from this description that every effort is made to avoid cracking in the economizer and evaporator, since low boiling fractions in passing through the converter are decomposed almost as readily as gas oil fractions. The larger part of the end products from such a decomposition is found in the fixed gas. For the same reason the raising of the vapors to the cracking temperature is done as quickly as possible. It is known also that any gasoline made at such low temperatures which might pass through the reaction zone unchanged would have inferior anti-knock properties.

The following table illustrates the yields obtainable from Mid-Continent crude charging stocks by a combination such as that described above:

	15° A.P.I. Pipe still bottoms	27° A.P.I. Topped Crude	30°-34° A.P.I. Gas Oil
Finished Motor Fuel	40.9	57.0	75.1
Fuel Oil	45.3	30.9	11.4
Gas (1350 B.t.u.)	10.9	11.9	12.5
Loss	2.9	0.2	1.0

One of the most interesting developments has been that involving the conversion of a goodly part of the fixed gas into motor fuel. By this process it has been found possible to convert half of the gas produced into a high-grade motor fuel rich in cyclic hydrocarbons and having a low average distillation range. In places where the value of the fixed gas is low because of a lack of outlets in the gas industry or in organic chemical synthesis this development offers the refiner an unusual opportunity for enhancing yields and profits. When combined with recent adaptations enabling the refiner to charge to the process pipe still bottoms some very interesting facts appear. For instance, by such methods it is possible to recover forty per cent or more of 420 degree F. end point finished motor fuel from a 15.0 degree A. P. I. pipe still bottom from Mid-Continent crude. When it is considered that this material is generally regarded as a low-grade fuel oil, the possibilities of the process are apparent.

In the refining of the distillate produced equally great strides have been made. In the beginning yields of 80 to 85 per cent finished motor fuel from end point distillate were to be expected. Constant work along this line has developed a series of treating methods, just as was done in the case of liquid phase cracked distillate. As a result

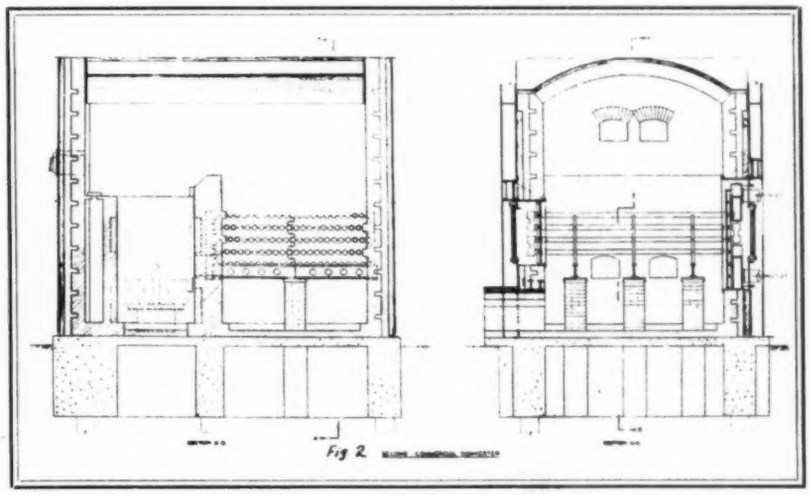
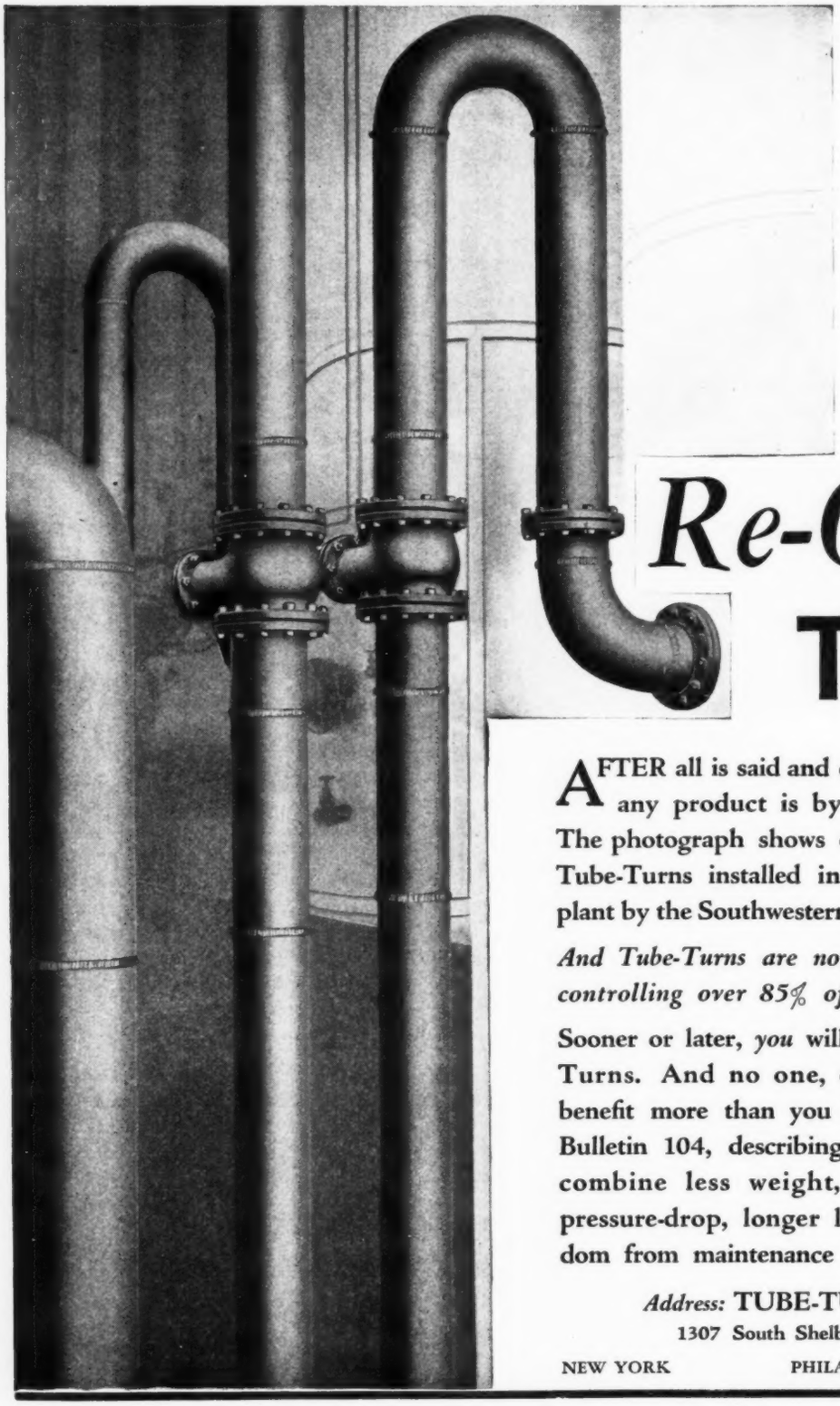


Fig. 2

Fig. 2



Re-Orders TALK!

AFTER all is said and done, the best way to judge any product is by *the companies it keeps.* The photograph shows one 6″, 90° and two 180° Tube-Turns installed in another natural gasoline plant by the Southwestern Engineering Corporation.

And Tube-Turns are now in use by oil companies controlling over 85% of the nation's production.

Sooner or later, *you* will probably switch to Tube-Turns. And no one, ourselves included, will benefit more than you by the change. Send for Bulletin 104, describing how Tube-Turns ideally combine less weight, greater strength, less pressure-drop, longer life and far greater freedom from maintenance demands. No obligation.

Address: TUBE-TURNS, *Incorporated*
1307 South Shelby St., Louisville, Ky.

NEW YORK PHILADELPHIA CHICAGO

TUBE-TURNS

NO BUCKLING OF INSIDE WALL — NO THINNING OF OUTSIDE WALL

THE STOCK FITTINGS FOR PIPE WELDING

DISTRIBUTORS IN:

Baltimore	Chicago	Honolulu	Maracaibo	Pittsburgh	Seattle
Cambridge	Cincinnati	Houston	Milwaukee	Portland	Tacoma
Charleston	Cleveland	Indianapolis	New York	Saint Louis	Toledo
Charlotte	Detroit	Los Angeles	Philadelphia	San Francisco	Tulsa

When writing TUBE-TURNS, INCORPORATED, *please mention The Petroleum Engineer*

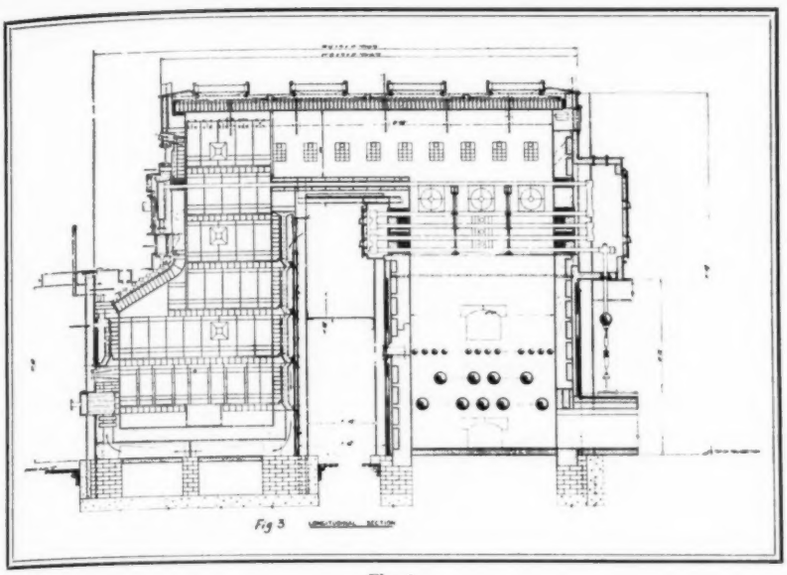


Fig. 3

of this work it is possible today to treat end point vapor phase distillate so as to produce 95 per cent of finished water white product. In the case of high sulfur distillates losses will be somewhat greater, if it is necessary to reduce the sulfur content to less than 0.10 per cent. It should be remembered, however, that the sulfur content of vapor phase cracked distillate is usually very much lower than would be the case if the same oil were cracked in the liquid phase.

One of the serious obstacles to the development of vapor phase cracking has been the gumming tendency of the motor fuel produced. It was necessary to overcome this difficulty, therefore, before such a fuel could be safely marketed. This has involved a tremendous amount of work on the nature of gum formation and the development of satisfactory methods for determining gum in motor fuels. Preliminary reports have been made on these investigations, and present indications are that a method for determining gum will be in shape to offer to the industry by the end of the year.

Chemical treatment of these highly cracked motor fuels has been developed to the point where it is now possible to insure their stability over a period of five or six months. In the following table are reported the results of one such test carried on under storage conditions in Florida, where the high temperatures cause the gum-forming reaction to proceed rapidly. Tanks No. 1 and No. 2 were transferred each week by means of a pump so as to observe the effect of increased contact with the air. Tanks No. 3 and No. 4 were not disturbed, but were in free communication with the air. It should be noted that fuels showing as much as 0.0100 grams of gum per 20 c.c. by this method give no trouble with present automobile engines, but above this figure some makes begin to experience difficulty.

The fuel used in these tests was handled in drums at the refinery and was some four to six weeks old before the test began. Although subjected to much worse conditions of storage than prevail in the marketing of motor fuel, this product is still harmless from a gum standpoint after six months. The cost of this stabilizing treatment is very nominal, not exceeding five cents per hundred gallons for most materials.

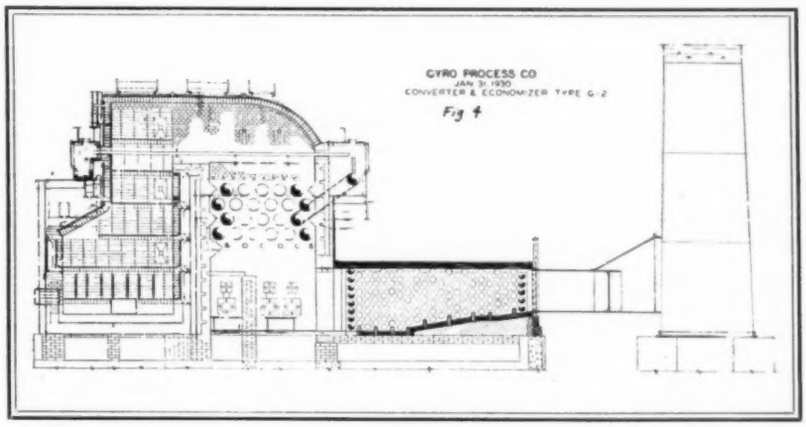


Fig. 4

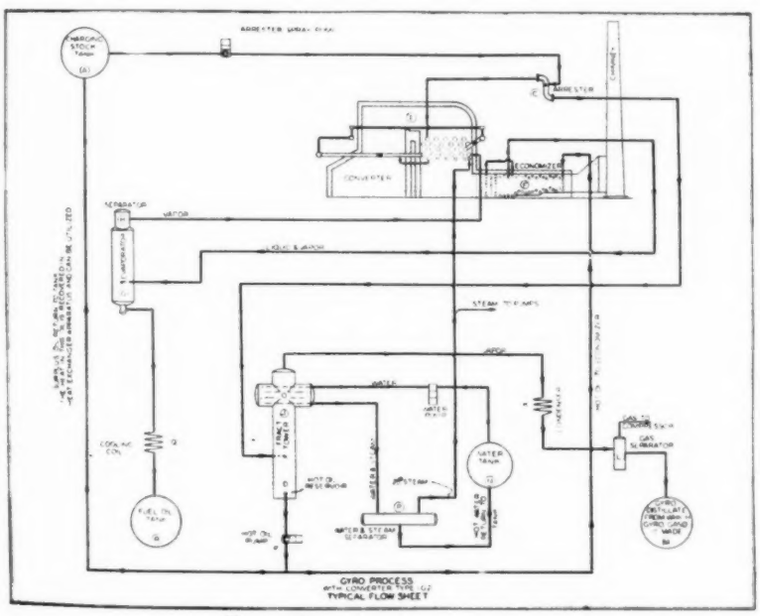
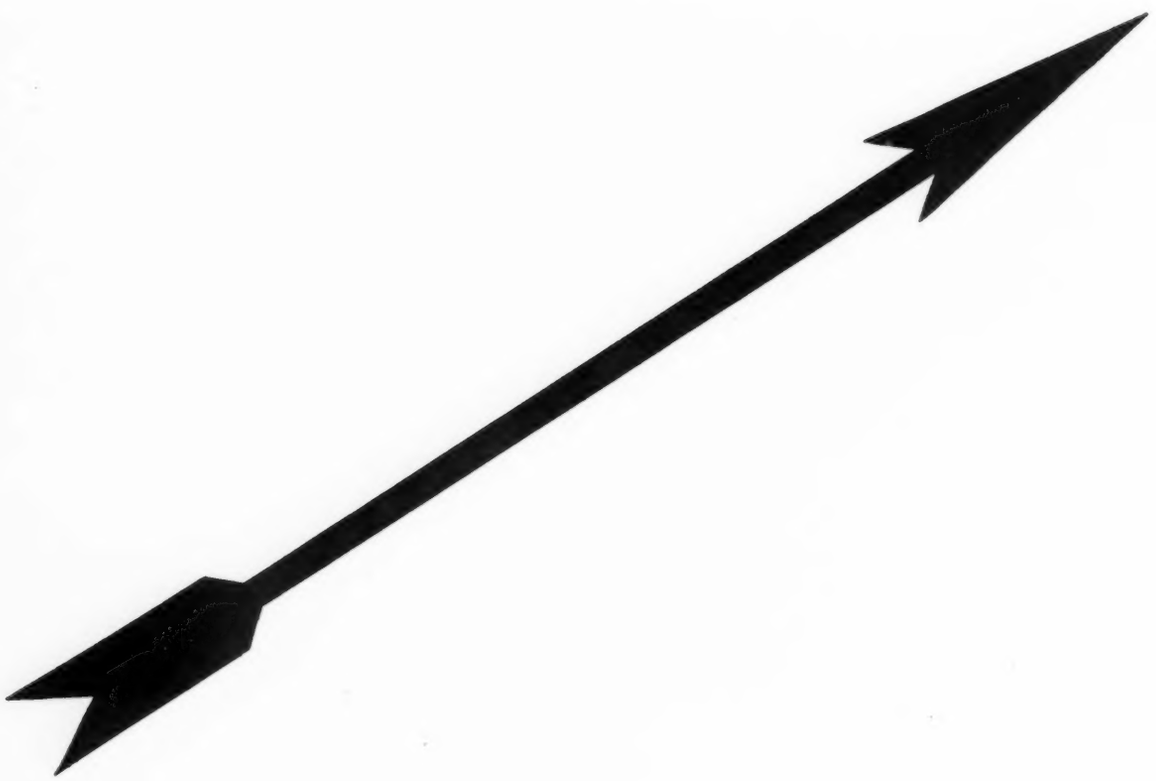


Fig. 5

	No. 1	No. 2	No. 3	No. 4
November 9th	.0011	.0014	.0017	.0017
November 16th	.0024	.0016	.0021	.0020
November 23rd	.0027	.0029	.0026	.0028
December 14th	.0045	.0037	.0036	.0037
December 21st	.0039	.0048	.0038	.0039
December 28th	.0050	.0041	.0039	.0041
January 4th	.0043	.0049	.0041	.0041
January 11th	.0051	.0044	.0042	.0043
January 25th	.0054	.0048	.0043	.0045
February 8th	.0056	.0052	.0046	.0047
February 15th	.0056	.0061	.0048	.0049
March 8th	.0067	.0061	.0052	.0052
March 15th	.0063	.0069	.0053	.0056
March 22nd	.0071	.0067	.0055	.0058
March 29th	.0064	.0069	.0055	.0057
April 5th	.0069	.0065	.0054	.0058
April 12th	.0067	.0064	.0055	.0059
April 19th	.0065	.0062	.0054	.0059



Commercial Department

OKLAHOMA GAS AND

J. F. Owens, Vice President and General Manager

The services of our engineers have played a notable part in increasing the use of electric power in O. G. and E. territory during the past 10 years 300 Times. This fact speaks for itself. » » » » » »

ELECTRIC COMPANY

Courteous, Personal Attention to Every Customer

Oklahoma City, Okla.

When writing Oklahoma Gas & Electric Co. *please mention The Petroleum Engineer*

Possibilities *of* Anti-Knock Fuels *and* High Compression Engines

By EARL BARTHOLOMEW*

ANTI-KNOCK fuels are now so widely distributed and constitute such a large percentage of the total gasoline sold in the United States that it is easy to forget they have not always been available. The history of such fuels dates back to 1923 when Ethyl gasoline was first sold, following a period of intensive research on knock suppressors by the research laboratories of the General Motors Corporation. Since that time fuels of varying degree of anti-knock quality have been produced by cracking, segregation and by the addition of benzene. Cracked fuels are also widely used as base stocks for Ethyl gasoline.

The present status of the anti-knock properties of motor fuels is extremely interesting and raises many questions concerning the automobile engines of the future as well as the nature of the fuels that will be available. The anti-knock quality of Ethyl gasoline has been increased from time to time as increases in compression pressure by engine manufacturers have justified a higher anti-knock standard. Some refiners have met this increase by the addition of greater quantities of Ethyl fluid, while others have wholly or partially met it by an increase in the inherent anti-knock value of their base stocks. In many cases the anti-knock value of anti-knock fuels other than Ethyl gasoline has been increased from time to time during the past few years. Although, in general, the level of anti-knock value of premium fuels has been raised in the last two years, there has not been anything approaching a corresponding increase in the anti-knock value of non-premium fuels. As a result, the differential in knocking tendency between the better anti-knock fuels and the poorer fuels of wide distribution has been very considerably increased.

Earl Bartholomew is Director of Engineering Laboratory of the Ethyl Gasoline Corporation. In this laboratory the "Series 30" Knock-Testing apparatus was developed after nine years of research work. It is used in the rating of the anti-knock properties of automobile and aviation motor fuels.

During this period it has been impossible for motor car manufacturers to choose ratios of compression that would permit the operation of their cars on a wide variety of fuels with efficiencies approaching those obtainable when full advantage was taken of the better anti-knock fuels. At the present time the spread in anti-knock value of fuels commonly available is approximately two ratios of compression for the average L-head engine. The car manufacturer is now confronted to an even greater extent by the same problem which he has faced during the past two years in the selection of compression ratios.

Although engine sizes have in general been increased, there has been a definite tendency to increase compression pressures by increases of compression ratio or by a reduction of the resistance of fuel induction systems. The table below shows the trend of compression ratios from 1926 to the present.

Compression Ratio of Automobile Engines

(On the basis of models.)

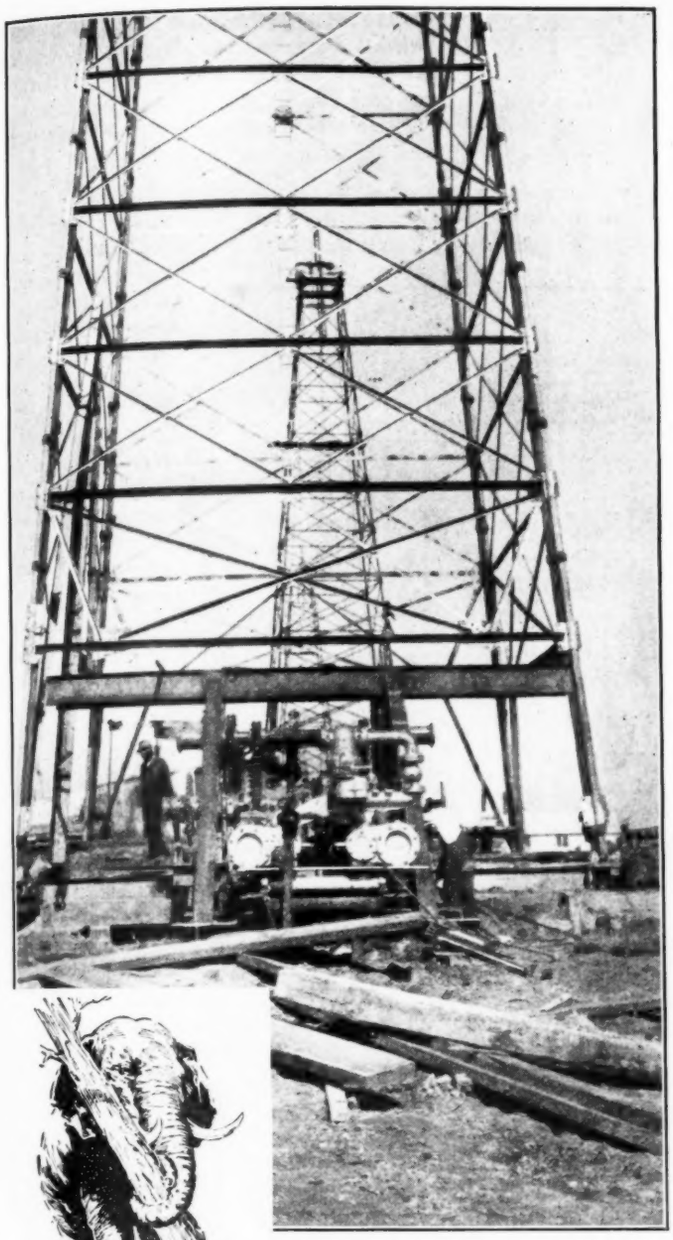
	1926	1928	1930
4.5 or less	33%	12%	3½%
4.5 to 5.1	64	67	21½
5.1 or over	3	21	75

* Director of Engineering Laboratory, Ethyl Gasoline Corporation.

It is now generally recognized that manufacturers can no longer hope to build engines which will operate satisfactorily on any non-premium fuel of wide distribution if they expect to equal the performance and economy of competitors' engines designed for the utilization of fuels of higher anti-knock value. It appears, therefore, that all manufacturers may soon be forced to the manufacture of engines of two ratios of compression, one to use the ordinary, badly knocking fuels and the other the high grade anti-knock fuels of wide distribution.

For some years many automobile manufacturers have attempted to provide greater acceleration by increases in engine size until now almost every manufacturer has, in at least one or two models, reached practical limit of cylinder size. Although it may appear that there is nothing to prevent the increase of bore and stroke indefinitely, there are, however, certain limitations imposed by the properties of metals and by the nature of combustion which have been quite keenly felt and have resulted in the widespread adoption of engines having a greater number of cylinders of smaller size. The expansion of metals in an automobile engine due to changes of temperature is a linear function of temperature difference and of the length of the parts. Certain clearances in automobile engines, however, are determined by entirely different considerations. For example, the expansion of pistons is proportional to changes in temperature and the diameter of the pistons themselves, but piston clearances are limited by the tendency to slap and by the prevention of blow-by and the dilution of crankcase oil. Experience has shown that piston troubles have increased tremendously with increases in bore. The piston clearances required in large cylinders for satisfactory operation at high speeds cause piston slap, rapid ring wear and excessive crankcase dilution at low speed. If large pistons are fitted with the close clearances necessary to prevent these undesirable happenings at low speeds there is excessive friction, which causes abnormal power loss and, in some cases, seizure of the pistons at high speed.

There is now a pronounced tendency to increase the number of cylinders in automobile engines. Although such engines have the possible disadvantage of increased friction because of the increase in the number of moving parts, they have the more important advantages of smoother operation, higher permissible compression pressure on a given fuel and the freedom from the troubles enumerated above, which are characteristic of engines of large bore. While it may appear that engines of all sizes should permit approximately the same percentage increase of compression ratio for a given increase in the anti-knock properties of the fuel used, research has shown that they do not. Efficient cooling becomes of increased importance at high compression pressures and the small bore engines, by virtue of their greater

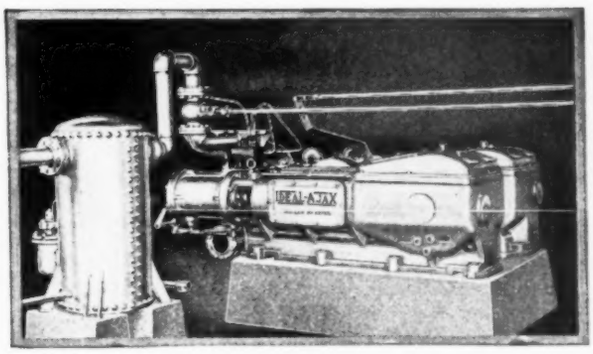


IDEAL-AJAX

Chosen for this 8,500 ft. Test Well

THE IDEAL-AJAX 12x12 Twin Roller Bearing Engine is here being rigged up to drill a test well to a depth of about 8,500 feet for the Texon Oil Co. of Big Lake.

The drillers selected IDEAL-AJAX knowing that they can count on its performance.



Latest Model IDEAL-AJAX Twin Roller Bearing Engine with Large Capacity Steam Separator.

All AJAX and IDEAL-AJAX users should investigate the possible value of hooking up a new Ajax extra-heavy Separator. It is essential with all piston valve engines and will increase the efficiency of all slide valve engines. It means much in lubrication . . . in time to get up drilling speed . . . and in steady performance.

IDEAL-AJAX

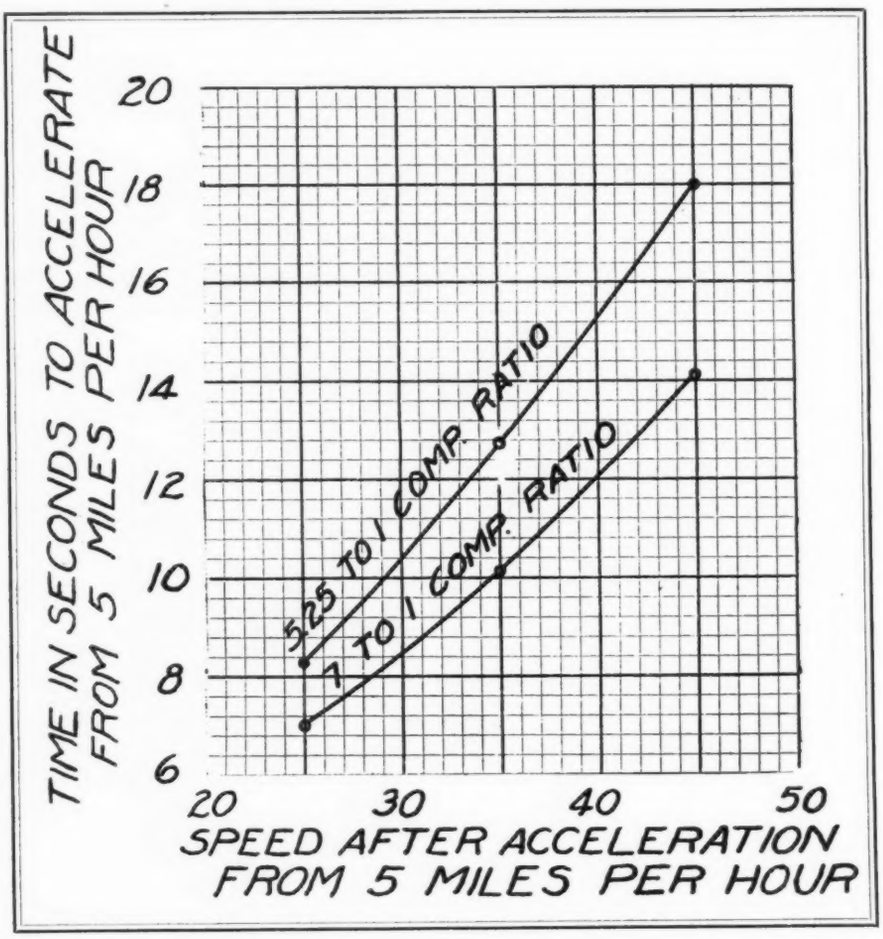
ROLLER BEARING STEAM DRILLING ENGINES

Made by **AJAX IRON WORKS,** *Corry, Pa.*

When writing AJAX IRON WORKS *please mention The Petroleum Engineer*

ratio of combustion chamber cooling surface to combustion chamber volume and because of the shorter distance which applied at the center of the piston must travel in reaching the cylinder walls, are extremely susceptible to the full utilization of the possibilities of high grade anti-knock fuels.

The temperatures encountered in high compression engines are lower for some parts and higher for other parts than for the corresponding parts of low compression engines. During the last three or four years, however, materials for engine construction have been developed to a point where compression pressures far in excess of those commonly used today may be used without any difficulty. Up to the present time characteristics of available fuels and not those of materials have limited compression pressures.



The engineering laboratory of the Ethyl Gasoline Corporation has done during the past year a considerable amount of testing of several types of engines of 7-to-1 compression ratio. Strangely enough, increase in compression of two full ratios has resulted in practically no increase in engine roughness. The first of these tests were conducted on six-cylinder engines having seven-bearing crankshafts. It was believed for a while that perhaps the number of bearings accounted for the absence of increased roughness, but subsequent tests on eight-in-line engines having five-bearing crankshafts confirmed the previous findings.

Increasing the compression pressure to obtain better acceleration and higher top speed is the most economical means for obtaining increased performance. Fig. 1 shows the acceleration characteristics of two automobiles having identical eight-in-line engines except for compression ratio, which was 5.25 on one engine and 7.00 on the other. It will be noted that the increase in acceleration over the whole range from 5 to 45 miles per hour is almost 20 per cent. The top speed of the two cars was 72 and 76 miles per hour respectively. The increase in performance of the car with high compression engine was obtained with a fuel consumption considerably lower than that of the low compression engine.

The same increase in performance might have been obtained by an increase in the bore of the engine. This would, however, have necessitated a larger and heavier engine as well as a longer and heavier chassis. The principle of increasing engine bore and stroke as a means of securing flashier performance has been carried to its conclusion during the last few years. The result has been a very great increase in fuel consumption. The added weight of larger engines and of the larger chassis to accommodate them has necessitated further increases in size to provide the power required to accelerate the additional weight.

Although the results of an elaborate series of tests on the relation of bore to permissible compression ratio on a given fuel are not available, a sufficient number of data have been accumulated through experience to indicate that every ⅛-inch added to the bore causes a very appreciable increase in detonation tendency. Increases in bore, therefore, call for decreases in compression ratio, which in turn make necessary even further increases in engine size to provide the desired performance. From the above it is apparent that the laws of diminishing returns operate unfailingly when engine sizes are increased. It is believed that increases in compression pressure as a means of increasing engine performance will meet with increasing favor in the future. Summarizing, increases of engine bore and compression pressure offer the following advantages and disadvantages:

Increase of Performance by

Increase of Engine Bore	***Increase of Compression Pressure***
1. Engine weight increased;	1. Engine weight not changed;
2. Chassis weight increased;	2. Chassis weight not changed;
3. Car length increased;	3. Car length not increased:
4. Car cost increased;	4. Car cost not increased;
5. Efficiency lowered by reduced compression pressure permissible;	5. Efficiency increased;
6. Gasoline consumption increased;	6. Gasoline consumption decreased;
7. Premium fuel may not be required.	7. Premium fuel required;
8. Cost of fuel per mile increased.	8. Cost of fuel per mile less than for larger engine.

As stated above, the anti-knock value of premium fuels has, in general, increased during the past two years. Data available at present indicate that the next few years will see even greater increases, since improvements are constantly being made in the processes of refining petroleum to produce gasolines of superior anti-knock quality.

FLUID PACKED PUMP
FPP

MAKING HASTE SLOWLY

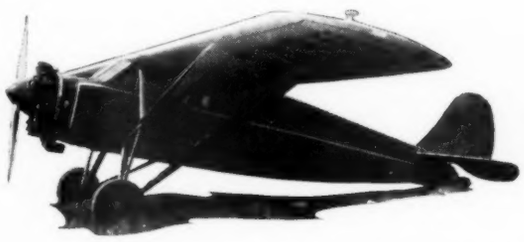
We point proudly to the fact that we have covered the Mid-Continent Field more thoroughly than rapidly. Six stores have been established, one at a time. No new store was established until its predecessor was completely self-sustaining. To-day, no store depends upon another but is a distinct Fluid Packed Pump stronghold, preserving the boundaries of Fluid Packed Pump superiority. When these boundaries are extended, that is the way they will go.

By this well-timed, logical procedure, the Fluid Packed Pump, with its smooth, tubular, telescopic action, has been made the boon to the oil fields that it deserves to be.

SERVICE POINTS

OKLAHOMA: Tulsa, Drumright, Seminole. KANSAS: Winfield.
ARKANSAS: Smackover. LOUISIANA: Shreveport.
FACTORY: Los Nietos, California

YOUR NEIGHBOR KNOWS US!



FLUID PACKED PUMP COMPANY
FPP *Mid-Continent* FPP
ROBERT N. ATMORE CO., Tulsa, Okla.

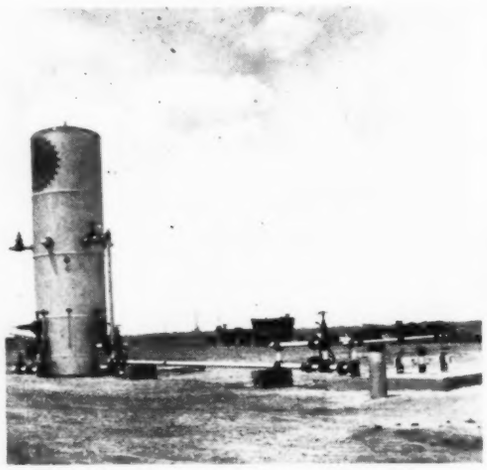
When writing ROBERT N. ATMORE COMPANY *please mention The Petroleum Engineer*

Drilling Conditions *in the* Hobbs, New Mexico, Field

By **HAROLD VANCE**, *Consulting Petroleum Engineer*

THE Hobbs field in central eastern Lea County, New Mexico, has the distinction of being the only field in the Permain Basin which was discovered by geophysical methods. The Midwest Exploration Company drilled the discovery well in 1928 on a predetermined geophysical high. Recent development has shown this discovery well to be very near the axis of the structure, but not on the highest point structurally.

The discovery well, Midwest Exploration Company's State No. 1, located in the northeast corner of section 9, township 19 south, range 38 east, was completed at a depth of 4245 feet with an initial production of 800 barrels of 35 gravity oil. Immediate developments following the completion of the discovery well was slow and confined to the area near it, due to the lack of an oil outlet. All of these wells were about the same size as the discovery well.



Humble Oil & Refining Co. well at Hobbs, N. M.

The Humble Oil and Refining Company, in order to protect a government permit, started a test in June of 1929 in section 30, township 18 south, range 38 east, some 2½ miles northwest of the discovery well. A hydraulic rotary was selected for the drilling. This well produced at the rate of 800 barrels per day at 2954 feet, which is above the top of the lime. At 3684 feet it produced 50 million cubic feet of gas in the lime. A string of 6⅝-inch casing was set through the gas and the well completed at 4106 feet with an initial production of 9000 barrels with a gas-oil ratio of 850.

View of the northwest extension of Hobbs field.

Methods of Drilling

Cable tools were used in drilling the Midwest discovery well. Two months were required to reach the top of the salt at about 1700 feet. Subsequent wells, drilled by the same method in this area, experienced the same difficulty. The unconsolidated and cavey character of the red beds, which occur above the top of the salt, was responsible for so much time being consumed in drilling to the top of the salt. The lime section, encountered at about 2950 feet, can be drilled very rapidly and economically with cable tools. Present practice in this area is to drill to the top of the salt with rotary and complete the well with cable tools. A string of 12½-inch casing is set and cemented at about 200 feet in order to protect fresh-water horizon. A string of 10-inch casing is set and cemented above the top of the salt at about 1700 feet. The hole is then drilled dry to about 4100 feet, where the 8¼-inch casing is set and cemented with sufficient cement to extend to the top of the salt.

In the vicinity of the Humble-Bower's well the rotary will probably be used exclusively. However, the hole may be spudded with cable tools to about 250 feet and 12½-inch casing cemented in order to get through the surface lime.

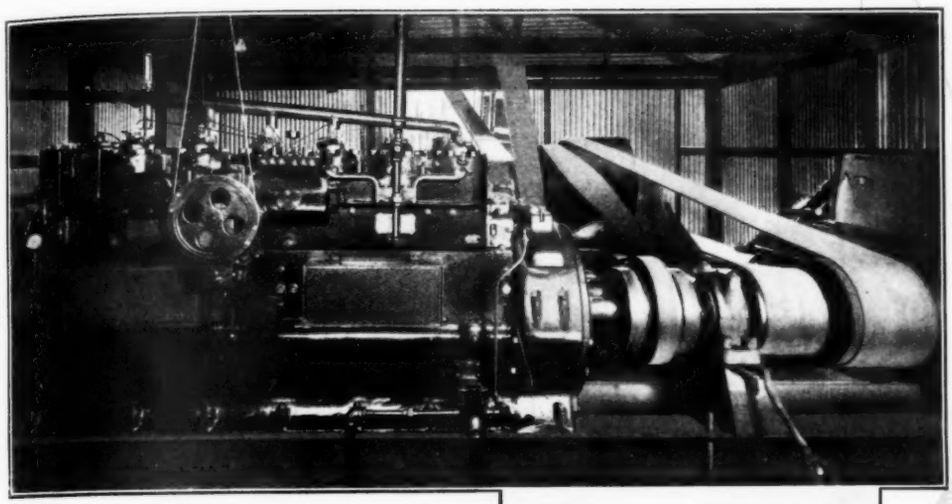
A string of 10-inch or 9⅝-inch casing will be set above the top of the salt or at the base of the salt and cemented. A string of 8½-inch or 6⅝-inch casing will be cemented above the top of the pay.

Heavy mastergates and blowout preventers will be installed on the second string of casing as a precaution against blowouts while drilling through big gas. Hard drilling will be encountered from about 3000 feet to the total depth.

The problem of controlling high gas pressures at relatively shallow depths is not new to Winkler County, Texas, and Southeastern New Mexico operators. The mud fluid should be thin to prevent gas absorption, but with sufficient weight so that the weight of the column of fluid above the gas will overbalance the known pressure by 100 to 150 pounds per square inch. This near-equalization of pressure is sufficient to control the well and will prevent the loss of fluid while drilling through a very porous horizon. It is entirely possible to mud off a porous lime pay by the use of improper mud fluid. The use of good mud fluid adds considerably to the cost of drilling, because all mud used in the bottom of the hole must be shipped into the field.

WORLD'S DEEPEST CABLE TOOL HOLE

DRILLED WITH FAIRBANKS-MORSE DIESEL DRILLING ENGINE



One of these engines recently completed an 8900 ft. hole in 167 days actual drilling time in west Texas, which is a **World's Record Depth** for Cable Tool Drilling.

The engine shown above is in service in Ector County, Texas, owned by contractor who has over a dozen of these engines

"If Continental Sells It . . . . There Is No Better"

THE CONTINENTAL SUPPLY COMPANY

General Offices: ST. LOUIS J633A

THE CONTINENTAL SUPPLY CO., LTD.
224 Traders Building, Calgary, Alberta, Canada
Export Offices: CONTINENTAL EMSCO COMPANY, INC. 74 Trinity Pl., New York
London Offices: 316-17 Dashwood House, Old Broad St., E. C. 2
CONTINENTAL EMSCO S. A. R., 7, Strada Eminescu, Ploesti, Romania

CONTINENTAL

When writing The Continental Supply Co.
please mention The Petroleum Engineer

Gasoline Engine Operation *and* Care

By H. L. KAUFFMAN

ENGINES included in the classification of internal-combustion petroleum engines comprise:

1. "Hot-surface" oil engines, both high and low pressure.
2. Diesel engines, with solid and air-blast injection.
3. Natural-gas engines.
4. Gasoline engines.

It is with the latter class, namely, gasoline engines, that we will interest ourselves in the present discussion.

First, let us understand clearly what is meant by internal-combustion petroleum engine.

An internal-combustion petroleum engine is a self-contained unit arranged to receive within its cylinder, vaporizer or combustion space, by varying methods in different types, either liquid heavy crude and fuel oil, petroleum, distillates or other similar fuels. Such products are first vaporized and intimately mingled in the combustion space with air compressed by the inward movement of the piston of the engine. Ignition of the explosive mixture thus formed then takes place with consequent evolution of the heat energy contained in the fuel which is thus converted into work. With the light, highly volatile fuels, gasoline, benzol and lighter distillates, a simpler process—that of carburetion—is followed; that is, the air in passing to the engine cylinder absorbs the fuel vapor.

A portable gasoline-driven compressor.

Four-Cycle Gasoline Engine Operation

The gasoline type of internal-combustion engine is widely used as a source of power in various phases of industry, besides its use for the propulsion of automobiles. The gasoline engine that is employed most universally is of the four-cycle or four-stroke type. Hence, a description of its operation is a matter of general interest.

Within each cylinder of the engine is a piston which has an upward and downward movement. This movement is controlled by a crankshaft to which each of the four pistons is attached by means of a connecting rod and piston pin. The full movement of a piston in either direction is called a stroke. There are two strokes of the piston to each full revolution of the crankshaft. By "one cycle of the engine" is meant the complete cycle or circle of operations which takes place in the engine from the time the charge of gas is first drawn into the cylinder until it is again time for a new charge to be drawn in.

In the four-stroke cycle engine four strokes are required for one complete cycle of operation, i. e., one down stroke, one up stroke; one down stroke, one up stroke. It will be seen that in any engine two strokes of the piston (one down stroke and one up stroke) are required for one revolution of the shaft. These four strokes are named in the order in which they always appear, namely: (a) Suction Stroke, (b) Compression Stroke, (c) Firing or Power Stroke, and (d) Exhaust Stroke.

There are two valves to each cylinder, the intake valve and the exhaust valve, for the purpose of opening and closing passages between the intake and exhaust manifolds and cylinders. The valves are made to open by the action of cams upon a camshaft located within the crank case, and driven at half crankshaft speed, through gears driven by the crankshaft. They are closed by springs.

If the crankshaft of the engine is revolved until the first explosion occurs, the following action takes place within the cylinder:

Upon the Suction Stroke (a) of the piston the intake valve is mechanically opened, and as the piston moves downward gas is drawn from the carburetor (by the partial vacuum created) into the increasing space between the top of the piston and the head of the cylinder. (The exhaust valve is closed at this time.)

At the end of this stroke the piston starts upward ([b] Compression Stroke), both valves are made to close and the gas is compressed into a small space, making it highly explosive. When the end of the stroke is reached, and just as the piston starts downward again, the compressed charge is ignited by means of an electric spark which takes place between the points of a spark plug screwed into the top of the cylinder head.

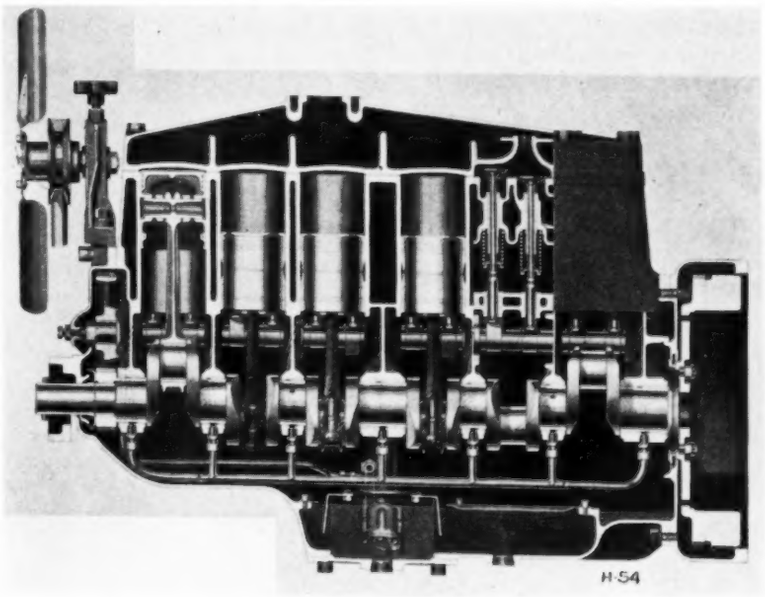
The ignition of the gas causes an expansion or explosion which drives the piston rapidly downward ([c] Firing or Power Stroke), at the same time imparting movement to the other five pistons which are attached to the main crankshaft. Both valves remain closed during this stroke.

In the next stroke, which is upward ([d] Exhaust Stroke), the exhaust valve is opened to allow the burnt gas to be forced out by the piston through exhaust manifold and

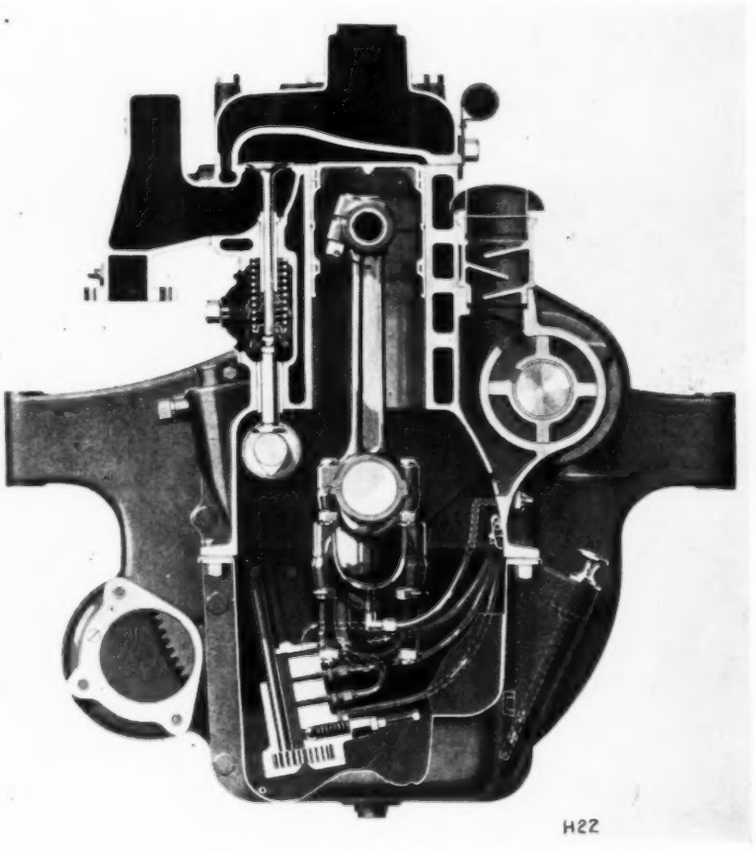
muffler into the open air. The intake valve remains closed during this stroke.

These strokes follow each other in the manner described as long as the engine is in operation and exactly the same series of actions occur in all six cylinders, although no like strokes are taking place at the same time in any of the cylinders: One is on its Suction Stroke, one on its Compression Stroke, another is on its Firing Stroke and one is on its Exhaust Stroke. In this way the explosions are so divided that there are three power impulses to each revolution of the crankshaft.

In a six-cylinder engine the explosions always occur within the cylinders in the following order: No. 1, No. 5, No. 3, No. 6, No. 2 and No. 4. In a four-cylinder engine they occur in this order: No. 1, No. 3, No. 4 and No. 2. This is termed the firing order of the engine. No. 1 cylinder is the one nearest the radiator.



Sectional view of 6-cylinder engine.



Sectional view of 4-cylinder engine.

Two and Three-Port Two-Cycle Engine Operation

The two-port two-cycle internal combustion engine is widely used for the propulsion of motor boats, in addition to various industrial applications.

Essential parts of this type of engine are a piston working within a cylinder and connected to a crank which imparts a reciprocating motion to it through a connecting rod; a passageway or duct opening into and connecting the cylinders with the crankcase; an exhaust port leading from the cylinder to the open air; a carburetor, or other mixing device, attached to and opening into the crankcase; a check valve (often combined with the carburetor), for admitting the explosive mixture into the crankcase and for preventing its escape during compression within the crankcase; and a projection or deflector on the piston for directing the inlet gas upward toward the head of the cylinder, thus avoiding a loss of the fresh charge with the exhaust gases. Usually the two-cycle engine contains neither inlet nor exhaust valves—the piston itself performing all the functions of the latter. It should be noted, too, that the dimensions of the crankcase of this type of engine are reduced to the smallest possible volume, so as to afford compression of the explosive mixture within the crankcase when the piston descends.

In a two-port two-cycle engine the operations are as follows: As the engine turns and the piston ascends within the cylinder, the exhaust and inlet ports are closed and the explosive mixture is drawn into the crankcase through the carburetor and check valve. This is the crankcase inlet stroke. When the piston descends the explosive mixture is compressed within the crankcase and, at the lowest position of the piston in the cylinder, the inlet passageway is uncovered and the compressed charge imprisoned within the crankcase escapes into the cylinder, filling same. Now the piston again ascends—closing the inlet and exhaust openings—and compresses the charge within the cylinder, at the same time drawing the new charge into the crankcase. At the top of the stroke the charge is ignited and the exploded gases drive the piston forward—permitting expansion, delivery of power and the compression of the new charge within the crankcase.

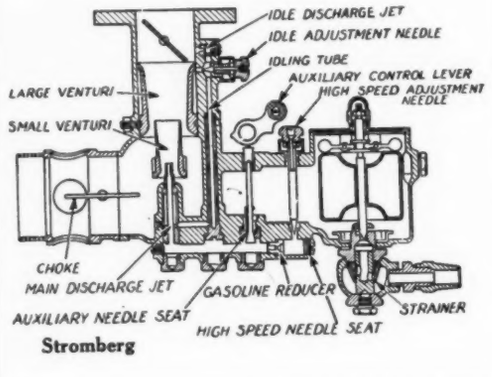
At the end of the power stroke both the inlet and exhaust openings are uncovered, the burned gases escape through the exhaust port and, simultaneously, the fresh charge entering the cylinder through the inlet passageway strikes the deflector and is directed toward the top of the cylinder. This rapid inrush of the new charge aids in scavenging and in driving out the burned gases through the exhaust port. Cylinder compression and crankcase depression again takes place as the piston ascends and covers the inlet and exhaust openings.

In the three-port two-cycle engine the third port leading from the carburetor to the crankcase is closed by the piston before the crankcase compression stroke. It should also be mentioned that no check valve between the crankcase and carburetor is necessary, as in the two-port engine.

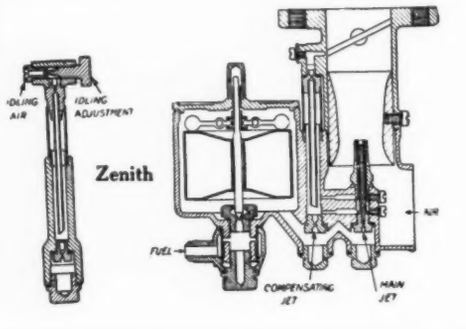
The operation of the three-port engine, which is somewhat different from the two-port, is as follows: As the piston ascends on the inlet stroke an increasing vacuum is created within the crankcase until the lower part of the piston uncovers the third port and thus allows the in-rushing mixture from the carburetor to fill the crankcase. As the piston descends the third port is again covered and the explosive mixture is compressed within the crankcase. At the lowest position of the piston in the cylinder the inlet passageway is uncovered and the compressed charges escape into the cylinder. In all other respects the cycle of operations within the cylinder and crankcase of three-port and two-port engines are exactly the same.

Bear in mind, above all things, the basic difference in the operation of four-cycle and two-cycle engines: In the four-cycle engine all operations take place separately within the cylinder above the piston, whereas in both two and three-port two-cycle engines the operations take place on both sides of the piston; that is, within the cylinder and within the crankcase, two operations occuring at each stroke, compared to one operation in the four-cycle engine. An explosion takes place and power is delivered once every two piston strokes or one revolution.

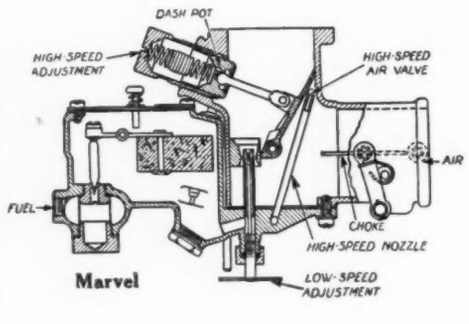
Stationary internal-combustion engines are made to operate either on the explosive or on the combustion principle, both types employing the two-stroke or four-stroke cycle. Engines of this class are regulated by governors to run at a uniform speed, provision being made for taking care of variable loads by increasing or decreasing the quantity of the charges or by making its delivery intermittent.



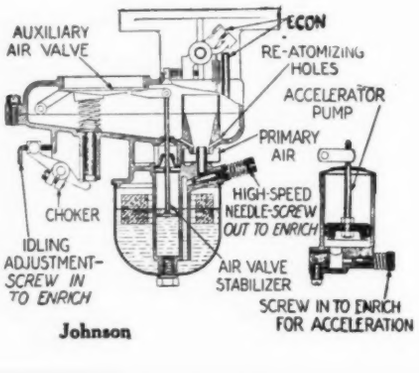
Stromberg



Zenith



Marvel



Johnson

Engine Care: Importance of Keeping Engine Valves Tight

The successful running of an engine depends primarily upon the valves being leak-proof and continuing to remain leak-proof for a maximum length of time. Consequently an important phase of engine operation and care is that of keeping valves tight.

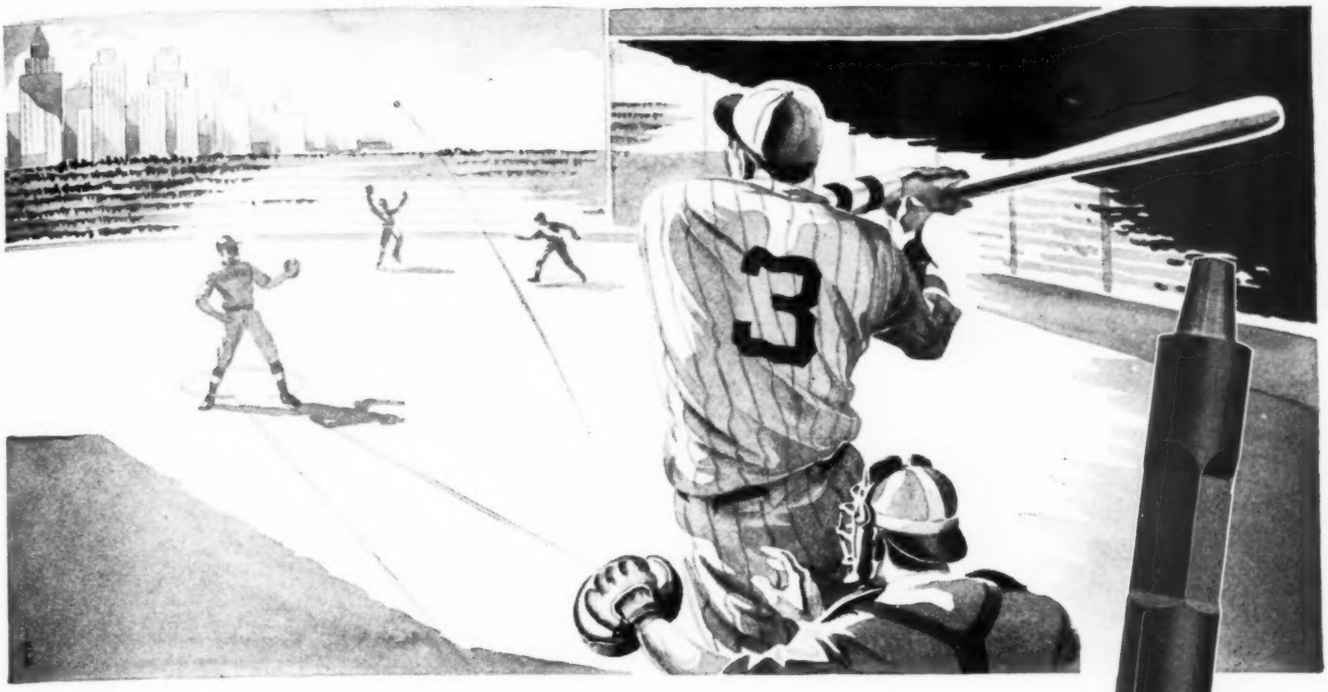
Engine-valve trouble will start very quickly from the use of oil of poor quality or unsuitable grade. True, poor fuel will make the cost of operation somewhat higher, but even poor fuel properly vaporized will cause no wear on the new engine; it can only cause wear through poorly fitted piston rings allowing too much oil to work into the firing chamber, where said oil picks up poorly vaporized fuel and, thus thinned, is readily washed back into the crankcase. This has the effect of diluting the oil in the crankcase and lessening its lubricating value. Use of a wrong grade of oil or of one that has been improperly or incompletely refined, on the other hand, will cause rapid wear of the piston rings and cylinder walls, and worn rings will allow oil to pump up into the firing chamber (where some of it burns to a carbon crust or scale) and fuel to wash down into the crankcase.

Large deposits of carbon scale in the firing chamber of an engine will cause pre-ignition or knocking, unless such carbon be removed. However, it should be mentioned that small pieces of this carbon are always working loose from the metal—due either to engine vibration or the quick action of the hot gases—and such carbon flakes must pass out of the engine by way of the exhaust valves. Now, should a piece of this carbon stick to any of the valve seats (and it very often does), it will keep the valves from closing properly. If the flake is hard the constant action of the valve working up and down will pound it into the metal of the seat. It is very important for the valve to fit the seat closely, in order both to avoid leakage and to assist in getting rid of the heat in the valve head.

Oil of good quality and of the proper grade will minimize wear on the piston rings, keeping them tight longer and allowing little excess oil to be burned or to pick up drops of unvaporized fuel in the firing chamber.

When a four-cycle engine is new the valves are tight, and there is a definite gap or clearance between the end of the valve stem and the push rod or tappet beneath, which lifts to open the valve. This clearance should be examined quite frequently, in view of the fact that the valve seats in a new engine tend to lower somewhat, due

THE WORLD'S MIGHTIEST BLOWS



EXEMPLIFY THE
GUIBERSON UNDERREAMER

THE RESOUNDING SMACK OF A HOME RUN CLOUT tells a story of drive and power delivered in a smashing impact with the ball. The hitter who keeps it up every day of the season is a super-man in balldom.

THE POUNDING BLOWS OF THE GUIBERSON UNDERREAMER tell a story of mighty strokes and a mighty tool to stand it. The Guiberson Underreamer is built to stand a longer and faster stroke day after day without developing any of the characteristic underreamer weaknesses. Its ability to do so has won it the title of the "The World's Strongest Underreamer."

Head and tongue are forged from a solid steel billet. Tongue being one piece with head, insides postively cannot pull out. Three times more downthrust bearing surface delivers a harder blow and withstands the jar. Cutters taper into the body with dove-tail fit, secured by both bolt and mandrel. Oversize and may be dressed many times on patented dressing form. To do the "home run" style of underreaming, use the Guiberson Underreamer.

"Better Be Safe Than Sorry"

THE GUIBERSON CORPORATION

Box 1106, Dallas, Texas

California Branch: 1506 Santa Fe Ave., Los Angeles

621 Kennedy Bldg., Tulsa | 321 S. Osage St., Ponca City | 506 Trust Bldg., Newark, O.

9

of a series describing the "World's Greatest Underreamer"

Fully Patented

GUIBERSON

BETTER BE SAFE THAN SORRY

When writing THE GUIBERSON CORP. *please mention The Petroleum Engineer*

to the constant seating of the valve in the cylinder block. This action has the effect of hammering the metal to a closer grain in the valve seat, making a more perfect fit, and insuring against any power loss from leakage. As a matter of fact it is said that the iron in the valve seat is actually changed in character by the constant peening action of the valve head, the iron becoming harder with use until it finally assumes a burnished or glazed appearance. If this finish is maintained it will insure a long operation of the valve without regrinding. It is well to bear this in mind when regrinding a valve and to avoid the use of a reamer or valve seating tool as much as possible. These tools have a tendency, in unskilled hands, of removing too much of the hardened metal of the valve seat, thereby causing the reground valve to sink more than it should.

Should the valve clearance or gap close up, due to seating in of the valve, and no attention be given to keeping it at the proper distance, sooner or later trouble is certain to occur. This is because of the fact that the valve head, though a part of the firing or combustion chamber of the engine, differs greatly from the other sections of these walls.

Every portion of the firing chamber of an engine has a means of cooling. When it has not, that section will quickly become red hot. Cooling is obtained by running water around the cylinder heads and barrels, while the head of the piston loses its heat by running in the cooler barrel and through contact with the oil splashed up inside by the connecting rod or crankshaft. The valves (more especially the exhaust valves) must get rid of their heat in a different manner; the intake valve is generally kept cool by the incoming stream of cold gas and, for that reason, usually gives very little trouble; the exhaust valve loses most of its heat through touching the cooler valve seat. The exhaust valve has not only its head exposed to the heat of the firing chamber, but its stem as well, during the time the valve is open and the hot gas is rushing out. Since the valve stem is quite small, very little of the heat can pass out of the valve head through same. It is self-evident that the longer the valve head is in contact with the seat, the more rapidly will it lose its heat. Consequently, engine designers endeavor so to arrange the timing or valve lift that the valve will have the longest possible contact with the cooler cylinder seat and yet open quickly enough to allow the engine to work properly. In a representative make of a four-cycle engine the exhaust valve is in contact with the seat over two-thirds of the time; while the intake valve is in contact for seven-tenths of the time. Efficiency in engine operation therefore demands that the valve seats be kept as nearly perfect as possible.

Another point of utmost importance in order to have an engine operate most satisfactorily is to follow closely the manufacturer's recommendations as to tappet clearance for, the nearer the tappet clearance is held to recommendations, the longer will the valve head be in contact with the cold seat and, consequently, the cooler will it run. Usually manufacturers' tables call for less clearance on the intake valve tappets because of the fact that these valves run cooler than the exhaust valves.

If the proper clearances or gaps are not maintained the valve will remain open longer and will run hotter; and, with the high heat, carbon deposits or metallic scales will form—especially where the valve head does not fit the seat properly. When this condition occurs, the scales do not permit the heat to pass from the valve head to the seat and, being very hard, they will—as previously mentioned—gradually cut the valve seat away. In a very short time the valve head will be running red hot, being unable to get rid of its heat except possibly in a very small spot. Operation in this condition without regrinding will soon result in a badly burned valve with subsequent loss of compression and power. For this reason, until a new engine is well broken in, inspection of the tappet clearance should be as frequent as circumstances will permit.

Valve grinding is one of the most important repairs on an engine. If it is not done properly, there is soon the need of a more serious repair such as putting in a new valve or even the replacement of the cylinder block itself.

Hints on Engine Operation

Carelessness in the operation of an engine may mean overspeeding; running with dirty oil; dirty plugs or a poor ignition system; a bad carburetor or poor adjustment of same; insufficient cooling water; a slack fan belt; or any one of a hundred different things. Careless repairs may mean a poorly ground valve; badly fitted rings; loose bearings, and the like.

To get maximum efficiency and longest "life" from an engine, the following operating hints are here offered:

1. The engine should be kept clean, and oil should never be allowed to collect on the wires or electrical equipment.
2. Keep the radiator filled with clean water and do not run the engine without water in the cooling system, or add cold water to an overheated engine. If the radiator leaks, have it repaired. Do not use radiator cements that are applied internally, as they hinder the cooling action of the radiator.
3. Use the carburetor choke no more than necessary, as this allows raw gasoline to enter the cylinders, pass the pistons and dilute the oil.
4. In starting a cold engine let it warm up slowly. Never race it.
5. If the engine knocks under a heavy load, retard the spark until it operates smoothly.

To insure long service from an engine, a general inspection of same should be made at regular intervals. One hour a week spent on this inspection will save time and money in the end.

Concerning the importance of adequate lubrication of gasoline engines, The Buda Company, manufacturers of Buda four-cycle gasoline engines, have the following to say:

"Oil, enough of it, and a good grade, is the most important thing in the operation of an engine. We can not say too much about the need of good oil of the proper body. * * * That an engine will use little fuel of course is important, but no good is accomplished by an engine that is saving in fuel when it is not or can not be oiling properly. The matter of fuel saving is largely one of fitting a good carburetor or keeping it adjusted and operating with a hot spark, properly timed. * * * Should an engine burn too much fuel, this can be quickly noticed and corrected, but it is unfortunate that the trouble caused by a poor oil is seldom noticed until it is too late to do anything."

The point brought forth in the foregoing paragraph needs no further comment, but it is one that can be borne in mind to advantage by all who operate or service gasoline type of internal-combustion engines.

Operators Find Placing of Sand Trap Over Casing-Head Reduces Cutting

THE tremendous pressures in the Oklahoma City oil field have been a constant source of annoyance and grief to the operators in that pool. This has been especially true in the sand producing areas, where valves and other parts of the connections have suffered exceptional wear due to sand cutting. In some cases the amount of sand brought to the surface by the heavy pressures has been so great as to cause dangerous conditions to arise within a short time.

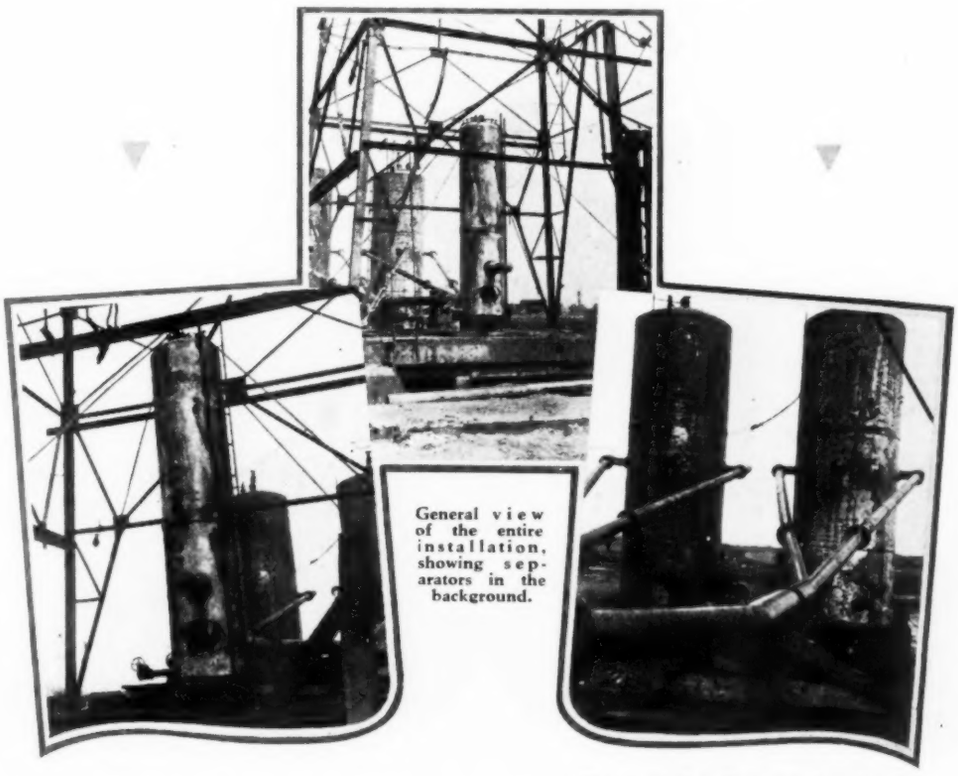
There have been many novel ideas tried in the field, several of which have proven helpful in reducing the amount of destruction caused by the sand. The latest idea that is now being tried by several companies is the placing of a sand trap, or expansion chamber, over the top of the casing head as it projects through the floor of the derrick, into which the well is allowed to flow.

Skelly Oil Company engineers were the first to attempt this plan, but since that time it has been used by Coline Oil Company, Sinclair Oil & Gas Company, and Slick, Anderson & Pritchard.

The theory of this new practice is to permit the oil to cushion against itself. When the flow enters the trap it is thrown against the heavy top plate by its own force. Naturally, all the time the well is flowing there is certain to be a quantity of oil in the top of the trap, since it must return to the bottom to go out the flow lines to the separators. This cushioning effect, together with the natural gas expansion, greatly reduces the amount of wear that the sand might cause if allowed to spend its full force on the metal.

The sand trap used is three feet in diameter and 15 feet high. It is made of heavy flange steel. The top head is one and one-quarter inches thick. On the inside of the trap is a wearing plate that is also one and one-quarter inches thick and is 36 inches long. It extends downward from the head along the sides of the trap to prevent wear in this portion of the trap. About two feet above the base of the trap are the man-holes for the flow line connections. These are swedged projections held onto the trap by means of a collar. The flow lines are screwed into this projecting collar and are extended into the trap a distance of about six inches. If the sand should wear the end of the flow line that is in the tank, it can easily be replaced by shutting the flow of the well off with the cellar gates and merely placing a new line into the trap. The casing, as it comes from the hole, is extended upwards into the trap about two or three feet. This part of the casing is held in place by means of guide lines attached to the bottom plate of the trap. The entire trap is anchored to the corner posts of the derrick.

These sand traps are now being placed upon the market. Considerable comment is being heard on the novel idea, and its use is spreading.



General view of the entire installation, showing separators in the background.

Close-up view of sand trap set on derrick floor over casinghead.

Picture of flow lines entering the two separators on Slick, Anderson-Pritchard Hoopes lease.

RUSSIA WANTED THE BEST!!!

When Soviet Russia decided to greatly enlarge her refining facilities some of the most important work, after a thorough investigation by Russian engineers, was given to The Winkler-Koch Engineering Company. The accompanying photographs show a small part of Winkler-Koch equipment at Batoum on the Black Sea.

Winkler-Koch processes are found not only throughout the United States but in all parts of the world where there is need for the most modern and efficient equipment.

ENGLISH ASSOCIATE:
A. F. Craig & Co., Ltd.,
Paisley, Scotland.
EASTERN REPRESENTATIVE:
Frank deGanahl,
Grand Central Terminal Bldg.,
New York, N. Y.

The WINKLER-KOCH ENGINEERING CO.

Consulting and Construction Engineers
WICHITA, KANSAS

Chemical Method of Reclaiming Oil in Large Tank Bottoms

By C. H. WRIGHT, *Prairie Pipe Line Co.*

DURING the early summer of 1929 the steadily decreasing production in the old Stephens County, Texas, fields caused our company to abandon a considerable portion of a large size gathering system and replace with small pipe. At this same time we arranged to abandon our Rogers Station at Caddo, Texas, which, during the flush period of Stephens County, Oklahoma, was about a 60,000-barrel per day capacity station. Remaining on this station site were only two 37,500-barrel steel tanks which had been used as working tanks at this station. These tanks were erected and had been in use for approximately ten years. They had never been cleaned out, and during the first couple of years of their existence, flush production passed through them continually carrying, of course, much dirt, sand and sediment.

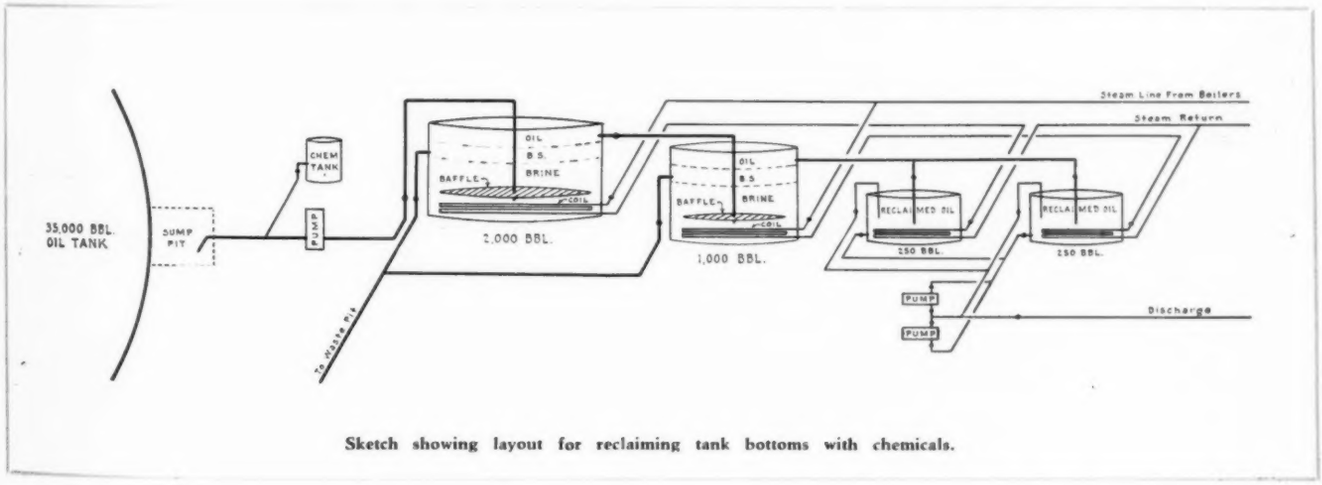
Upon decision to abandon this station and use the available equipment at other points an inspection was made of the two working tanks. Each was inspected in three different hatches and at intervals of four inches from bottom to top of contents. One tank showed, for the first three feet from bottom, 52 per cent water, 43 per cent BS and 5 per cent oil. The next two feet four inches showed 13 per cent water, 18 per cent BS and 69 per cent oil. Hatch No. 1 showed first oil at 40 inches, 10 per cent; first merchantable oil at 56 inches; top of fluid 64 inches. Hatch No. 2 showed first oil at 44 inches, 20 per cent; first merchantable oil at 52 inches; top of fluid 56 inches. Hatch No. 3 showed first oil at 28 inches, 25 per cent; first merchantable oil at 52 inches; top of fluid 56 inches. This showed a total of 1,705.55 barrels water; 2,660.06 barrels BS; 2,394.39 barrels oil; making a total content of 6,760 barrels.

The first three feet from bottom in the other tank showed 43 per cent water, 54 per cent BS and 3 per cent oil. Next two feet four inches showed 6 per cent water, 35 per cent BS and 59 per cent oil. Hatch No. 1 showed first oil at 36 inches, 10 per cent; first merchantable oil at 60 inches top of fluid 64 inches. Hatch No. 2 showed first oil at 40 inches, 10 per cent; first merchantable oil at 56 inches; top of fluid 64 inches. Hatch No. 3 showed first oil at 52 inches, 75 per cent; first merchantable oil at 56 inches; top of fluid 64 inches. This showed a total of 1,904.63 barrels water; 3,109.65 barrels BS; 1,751.72 barrels oil; making a total content of 6,766 barrels.

Total content of both tanks was, therefore, 3,610.18 barrels of water; 5,769.71 barrels of BS, and 4,145.11 barrels of oil, or a total of 13,525 barrels of fluid to be treated.

It must be understood that this inspection was taken at natural temperatures with the contents of the tanks in their natural condition. In other words, there had been no heat applied, no turbulence or mixing set up. It is hardly necessary to explain to anyone familiar with tank bottoms that they are an inconsistent mass and that there will be oil pocketed and entrapped throughout the depth of the solid matter. Likewise, water will be suspended in pockets in this same manner above the natural gravity level of the different contents based on their weight. By referring to figures presented later on in this article as to recovery, it will be noted that within 400 barrels of the amount of oil shown to be in the tanks by this inspection was reclaimed.

After inspection material necessary to install and operate a treating plant was assembled, it having been decided to employ chemical treatment in the reclamation of these tank bottoms. We accordingly selected a site opposite one of these tanks on which to set up our treating plant, cut a sheet out of the other tank, which was 500 feet distant, and transferred the contents of that tank into the tank adjacent to the plant. Most of the content of this tank was transferred through a duplex 10 by 18 suction pump located in the station, until it got too heavy to flow through the line and valves of this suction pump. The balance was transferred with a mud hog drilling pump. The content of this tank was handled down to within one foot of the bottom in this manner. It, however, necessitated a 500-foot steam line to get steam to the mud hog for this work, which added greatly to the expense. The balance of one foot was scraped out of the tank bottom and into the residue disposal pit, which we had provided below this tank for the disposal of all unreclaimable content from both tanks. We then dug a



Sketch showing layout for reclaiming tank bottoms with chemicals.

sump 9 by 15 by 6 feet deep at the reclaiming plant flush with the shell of the tank. A sheet was cut out of this tank and a mud hog pump set up as close as practical to the sump pit and connected up with a proper suction line protected by about one-half inch mesh steel screen to keep solid particles out of the pump. Sixty-five feet of two-inch steam coil, fed by live steam direct from the boilers, was installed in the sump. This raised the temperature of the contents of the sump to about 150 degrees to keep it liquid for handling by the mud hog.

The plant consisted of four 35 h. p. boilers, one 2,000-barrel steel tank 22 feet high, one 1,000-barrel steel tank 17 feet high, and two ordinary 250-barrel steel field tanks. This equipment was all in stock, and in explanation of the sizes and capacities of some of the equipment used, it might be stated here that the sizes and capacities were not arbitrary, nor were they even well synchronized with the different parts of the plant, but were used simply because it was all the material we had in stock and eliminated the necessity for purchasing any new equipment to do this work.

An Oklahoma tank farm which is about to be cleaned.

The pumping equipment consisted of two mud hog drilling pumps, one to pick up the untreated fluid from a sump at the tank in which it was located and the other to pick up the residue drawn off from the treating tanks and pump this residue to a disposal pit which had been provided at a convenient place and of sufficient capacity to take care of all residue derived from the treating of these bottoms. In addition to these two mud hog pumps, two 7½ by 2½ by 10 steam pumps were set opposite the two 250-barrel blending and shipping tanks, which served the double purpose of recirculating the oil with good field oil through the 250-barrel tanks for purposes of blending. These pumps were also connected into the main line so that after the reclaimed oil was properly blended it was pumped into the main line and shipped with other field oil in the line.

In the 2,000-barrel tank was placed 700 feet of two-inch steam coil 18 inches from the bottom of the tank. The same distance above this steam coil we built a platform or baffle out of lumber, with two feet of clearance between the edges of the platform and shell of the tank. About 18 feet above the bottom of this tank was placed a draw-off connection for BS and impurities in the oil which would float on water; 18 inches above this draw-off connection was placed another connection which siphoned the good oil from above the BS level into the 1,000-barrel tank. This 2,000-barrel tank was filled with water to just below the level of the BS draw-off connection. The water was impregnated with three barrels of salt in order to increase its specific gravity, which aided considerably in floating the lighter oil and the impurities in the treated oil.

The untreated content of these tank bottoms was pumped to the 2,000-barrel treating tank from the sump by the mud hog pump, the discharge line of which went over the top of the 2,000-barrel tank and down into the center of the tank below the baffle and just above the steam coils. From there it was necessary to circulate to the edges of the baffle and up through the salt water to the merchantable oil siphon, other lighter contents in the oil at the same time taking the same course and eventually coming to rest on top of the brine and just in under the merchantable oil level. The chemical used in this treatment was introduced through a sight feed lubricator connected to a container holding the chemical in bulk on one side, its discharge being connected into the suction line of the mud hog pump which picked the material out of the sump. The lubricator was regulated by a valve to the proper amount of chemical, balanced to the amount of fluid the pump was picking up from the sump, and the suction of the pump served to keep this chemical mixed and blended with the material to be treated in proper proportions with very little attention. After this oil passed through the heated brine in the 2,000-barrel tank and was siphoned over to the 1,000-barrel tank, which was equipped identically as the 2,000-barrel tank, it again went through the same process for purposes of washing and final cleaning and was siphoned from there to the two 250-barrel tanks. The 1,000-barrel tank was equipped with 600 feet of two-inch steam coil and with a baffle at the same distances from the bottom as the treating tank. Both 250-barrel tanks were used for the dual purpose of blending and shipping the oil and each was equipped with 60 feet of two-inch steam coil. Live steam direct from the boilers was introduced into the 2,000-barrel treating tank and the 1,000-barrel washing tank, but the discharge from the coil in the 1,000-barrel tank was connected direct into the coils of the two 250-barrel tanks, which furnished heat enough to blend the treated oil with fresh field oil in these two tanks.

The temperature recommended by the manufacturers of the chemical to be used in the treating tank was 140 degrees F. This temperature perhaps gives desired results in fresh crude from the field, but we found we had to increase the temperatures as near as we could carry them below the boiling point to obtain prompt and decisive separation of the good oil from the residue. Scarcely perceptible results were obtained with a temperature below 170, and best results were obtained at about 200 degrees in the treating tank. The washing tank was operated at practically the same temperature.

We installed, on the treating and washing tank, well thermometers with angle connections in order to keep check on temperatures we were carrying. These thermometers were installed as high on the shell of the tank as a man on the ground could conveniently read, as there was considerable temperature decrease from where the steam entered the coils to the top of the tank. Thermometers were installed immediately above the valves on the steam lines from the boilers to the coils in these two tanks so that the operator in charge could read his temperatures while regulating steam to the coils.

After the treated merchantable fluid had siphoned off of the wash tank into one or the other of the two 250-barrel

tanks, we introduced from our main line fresh crude from the field in proportions of about one barrel of crude to two barrels of treated oil. The 7½ by 2½ by 10 pumps were connected by suction to the bottom connections in these two tanks and their discharge was connected in to the top of the tank; also the manifold on the discharge made a connection into our main line from this point. When one of these 250-barrel tanks was fully charged with treated and crude oil in the proportions above mentioned, the 2½ by 10 pump was started circulating this oil through the tank at about 140 degrees F. and was so circulated until samples taken from the oil denoted a thorough blend, after which it was pumped into the main line and shipped. This blending process required about one and one-half hours circulating through the tank in order to secure a thorough blend and was then immediately pumped into the main line with some of the super-temperature still remaining in the oil.

During the time that we were cleaning the top or lighter portion of this content, c i r c u l a t i o n through this system was continuous at the rate of about 70 barrels per hour. However, when we got down into the heavier content where there were more solids, it became necessary to charge the treating tank and hold the charge in this tank for as much as an hour and a half before we secured satisfactory separation. We found in this respect that bottoms showing as much as 30 per cent or more oil could be circulated on continuous operation without holding it in the treating tank for further subjection to heat, but where the contents showed less than 30 per cent it was necessary to charge the treating tank as above mentioned and subject it to heat for a period of time. When we got down into this heavy stuff it, of course, slowed up the output of our plant considerably as, on account of the small space available between the BS draw-off connection and the siphon connection for siphoning good oil off of the treating tank, we were only able to charge about 145 barrels at a time. We found it necessary at intervals, depending on the content of the fluid being treated, to shut down and draw off the accumulation of BS which built up on top of the brine from the BS connection level to the good oil siphon level, which was 18 inches. This process required about two hours shutdown each time it became necessary.

A West Texas tank farm.

It is impossible to give any reliable data as to the exact time required from the time the untreated material is picked up from the sump until it passes through the system and is ready to be shipped into the main line from shipping tanks. However, as above stated, on the lighter content the process will be continuous up to the capacity of the plant, but upon reaching the bottom of it where there are more solids and more water it will have to be treated in charges of perhaps an hour and a half duration.

After our plant was set up and we had begun to bring over treated oil we used treated oil in our boilers for fuel. The oil brought over from the treating tanks averaged about 31 to 33 degrees specific gravity, and was very clean. It was constantly sampled for BS and very few of the many samples taken showed as much as 1 per cent.

The attendants at this plant consisted of four men. During this period we operated two tours of 12 hours each per day, which shows an average of about $20.00 per day for attendants.

We reclaimed these two combined tank bottoms from the final tank into which they were both taken to within nine inches of the bottom, the balance of the residue being mostly sand and sediment. We had a sump just opposite the treating tank and a mud hog pump set at this sump which pumped all residue drawn from this tank to the disposal pit about 500 feet away. All unreclaimable material was pumped by the mud hog to this disposal pit and allowed to remain exposed to the sun and wind until the treating was finally concluded. The disposal pit, being of shallow depth and large dimensions, allowed the elements to exercise a maximum of evaporation upon it. Salt water was mostly evaporated in this manner, and we finally, by a series of firings, disposed of perhaps 90 per cent of the r e s i d u e through b u r n i n g. Each burning would evaporate considerable water and moisture from the balance so that there was finally very little residue left to be disposed of, and which is one of the biggest problems in cleaning out tanks.

We had no trouble whatever in burning this reclaimed oil in the fireboxes of our boilers, as we installed a small steam coil in the fuel tank for the boilers.

Our records show that we reclaimed merchantable oil to the amount of 3,714.28 barrels at a cost of $1.8045 per barrel. The amount of fluid and matter handled from which we reclaimed this oil was 10,067.40 barrels, at a handling cost of 66.58 cents per barrel. In other words, 39 per cent of material handled was reclaimed. Out of this amount we used about 230 barrels for fuel. About 900 barrels was destroyed by a fire at the plant, and we pumped into our lines between 2,800 and 2,900 barrels.

After we had this plant installed and started to apply steam to our treating tank, we discovered that for some reason we could not get a radiation of heat within the tank. It was necessary to shut the plant down, go into the tank and dismantle our baffle and steam coils and reconstruct the steam coils, in order to get away from a water bound condition which we found, and get free circulation of steam. This consumed several days time and considerable expense in stand-by and labor. After getting the steam coils properly installed we again fired up the plant and had just got it nicely operating when, on account of not properly watching temperature control, the treating tank boiled over and ignited and also set fire to the contents of the washing tank. This fire burned and smoldered for several days before it could be extinguished. Following the fire, we had to have these two tanks regasketed and rebolted; had to rebuild our baffle, etc., which further increased the expense of the work, and this delayed us about ten days before we could resume operations. The principal reason for this fire was the fact that we had not allowed enough room from our good oil siphon in the treating tank to the top of the tank and when it became over-heated there was not sufficient capacity above this

siphon to take care of the boiling oil. This is a condition that can be easily remedied by dropping both BS draw-off connection and the good oil siphon connection about a foot lower on the treating tank and reduce consequently the amount of brine in the treating tank, which would not seriously interfere with the operation or capacity of the plant.

Our labor charges were extremely high, due to the fact that we had to lay considerable line to transfer the bottom of the one tank to the tank adjacent to the treating plant. Also on account of going over all pumps and machinery and reconditioning them and putting the plant in shape after the fire. It is safe to say that, had the plant been properly installed and no changes required from original installation, and had the fire not occurred, this oil would have been reclaimed at a cost of 75 cents per barrel or less.

It would minimize boiler and steam expense if this kind of work could be done in July and early August, as the temperatures at that time of year are a great aid to keeping the bottoms in a more or less fluid condition without artificial heat and would minimize to some extent the amount of heat required by steam coils to accomplish the separation.

One of the greatest problems in cleaning large tanks where there has been an accumulation of years, or four or five feet or more of accumulation, is the disposal of these tank bottoms. It has been very difficult to dispose of them where they will not pollute streams or stock water or spread over cultivated land and entail endless damage claims over a period of years. It is impractical to bury this stuff as long as there is any oily content remaining in it, as this content will gradually separate from the solids and come to the surface for years afterwards whenever there is a rainy season. I believe, however, that we have successfully disposed of the residue from these two tanks so that there will never be any trouble from this source, although the disposal pit is not over 200 yards from the banks of Caddo Creek.

This was the first attempt we had made to chemically reclaim tank bottoms, and from the experience gained in this instance, profiting by our mistakes to guide us to proper installation and operation of future plants, it appears to be a very desirable manner in which to take care of this troublesome task, as it does not require any material of any kind that is not in stock on any pipe line or producing property. Also, all material and equipment used for this purpose can be diverted to its regular uses in the field and not lay idle and useless over long periods.

A Cause for Excessive Aviation Oil Consumption

By WARD F. DAYTON, *Texas Pacific Coal and Oil Co.*

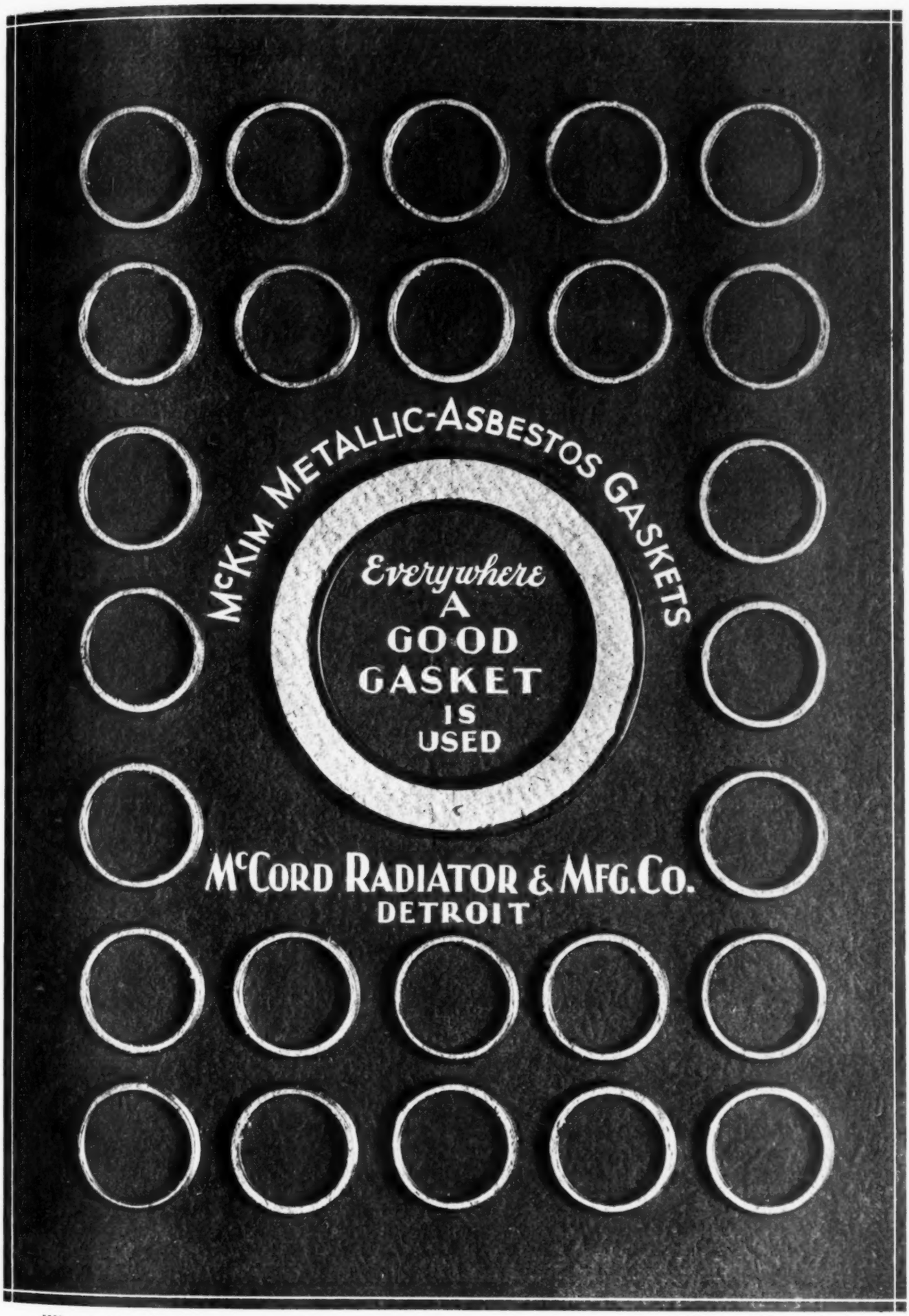
DURING the past few years the aircraft industry has developed to the progressive assembly stage. This, of course, meant a very serious shortage in master craftsmen—men who understood the tools of the aircraft trades and how to use them. One of the departments of the industry hit the hardest was the assembly room of the engine-manufacturing plant.

The oil refining industry felt this shortage soon after the progressive assembly stage of the aviation engine was reached, by the cry of the aircraft operator that your oil is running high in temperatures and consumption. Better oils were developed, and still the cry. What is the answer? There are several mechanical reasons existing that are gradually being eliminated by the training of competent mechanics and improved methods in engine manufacture and design, as demonstrated by the ever-increasing number of hours between oil changes and the hours between major overhauls on aircraft engines.

The author, having been engaged in the aircraft engine industry for nearly ten years, writes from a varied experience, and lists as follows one of the various mechanical reasons for high oil consumption and operating temperature that the oil was blamed for until the manufacturer discovered it and remedied it in new engines. This same condition will still be encountered in aircraft engines that are overhauled by mechanics who are not expert.

Whenever an air-cooled aircraft radial engine is given a major overhaul and it is found necessary to replace the master rod crank pin bearing, and the oil consumption is high and the operating temperature also high, it will be found on close examination that the bearing has a small spiral groove in it. This will be found in a majority of cases. The action of this bearing with the spiral groove is that of a pump, pumping the oil delivered through the crankshaft to it out into the main crankcase, where it is churned into a foam by the whirling crankshaft and master rod assembly and deposited on the hot cylinder walls and pistons in larger quantities than required. A larger amount of oil passes the rings, because there is a larger amount on the cylinder walls to pass, mostly through the ring gaps and low spots, resulting in high oil consumption. A great amount of the explosion heat is absorbed by the oil coming into contact with the hot pistons and cylinder walls. The oil is circulated much faster through the engine, per minute, which means less time to cool and results in increased temperature and decrease in viscosity and also increase in consumption of oil.

This spiral groove is caused by inexperienced mechanics' handling; burrs on the cutting edge of master rod bearing reamer; low spots on the cutting edge caused by stoning to sharpen.



When writing McCord Radiator & Mfg. Co., Gasket Division, *please mention The Petroleum Engineer*

Importance of Maintaining Pipe

By **L. A. FARMER,** *Supt. of*

Interior view of Oklahoma Natural Gas Corporation's recently-built garage. Note ample lighting, room, individual cranes and long work benches.

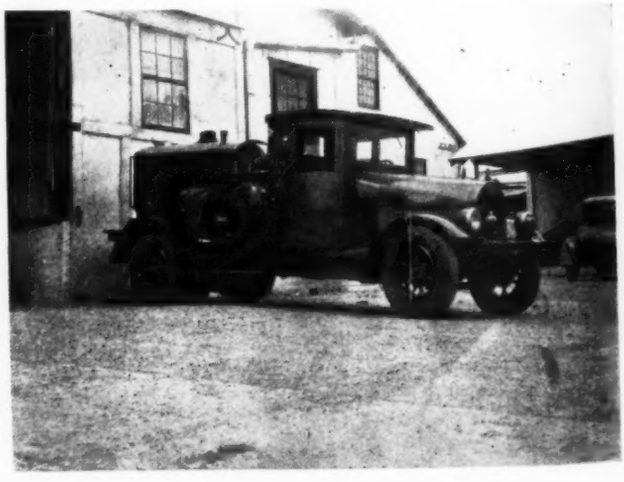
IN the operation of a gas pipe line system the importance of automotive transportation has reached the point where it is second only to labor both from the increased efficiency in plant operation and from the point of expenditures necessary to maintain an adequate fleet to give the service required. There is no question as to the absolute necessity for motor transportation both of the passenger and commercial type, but only in gaining the greatest value for every dollar expended. Especially is this true of gas utility companies whose source of supply must come from a large number of wells over a widely scattered territory.

Only a few years ago a field man with the assistance of a horse and buck-board would take care of from five to ten wells over an average distance of twenty-five miles per day. Today the same man driving an automobile will take care of from twenty to forty wells over a distance of one hundred miles, and will usually have his day's work completed in less time than before. In one of the larger cities of Oklahoma it was found that a service man could make three times the number of calls by the use of an automobile at an increased cost of just over two dollars per day. Less than ten years ago practically all of the moving of materials from the railroad station to pipe line and compressor station was done with teams at an average cost of fifty to sixty cents per ton mile, while today this is being accomplished by trucks at a cost under ten cents per ton mile where conditions are favorable.

A large number of improvements have combined to make these savings possible. Good highways, pneumatic tires, more powerful and efficient trucks, so that the average operating cost per mile has not only been reduced by almost fifty per cent, but larger loads are being moved at several times the speed of a few years ago. Balloon tires, shock absorbers, more flexible springs, and high-speed motors enable the operator of passenger vehicles to cover large distances with little discomfort.

While this has greatly reduced the number of men required for general operation, the expenditures necessary for automotive transportation have increased until this assumes a major place in operating expenses. It is quite often that the operating cost and depreciation of a vehicle will amount to as much or more than the salary of the operator.

The successful operation of a motor fleet is divided into three distinct divisions: operating, maintenance and accounting. Each of these divisions must function properly and with the closest co-operation in order to achieve the desired results. No maintenance man could establish a record of economical operation of vehicles unless he had the assistance and co-operation of the operators of the vehicles. Neither can the operating and maintenance divisions accomplish very much unless they have a good system of accounting to show them what they have accomplished and to guide them in eliminating future



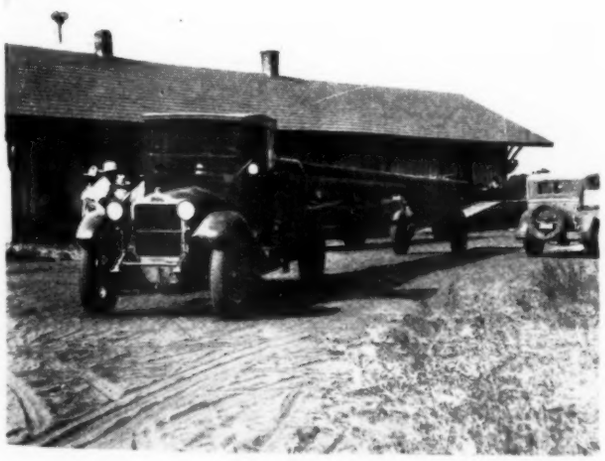
Reconditioned truck hauling auxiliary equipment.

Line Automotive Equipment

Warehouses, Oklahoma Natural Gas Corp.

leaks. The individual driver is the largest contributing factor to the economical operation of motor equipment. This can be readily seen in the wide variation in operating expense of the same type of vehicles in similar service. While the drivers of passenger type vehicles are not chosen for their ability as drivers, there will be very few instances of deliberate abuse if they understand that the care and operation of their equipment is a vital part of their job. This is somewhat different in the case of drivers of commercial vehicles since they are chosen for their ability to care for and to operate the equipment which they are using, and the success of their job depends on the successful operation of their equipment. The fleet operator should see to it that all drivers are instructed in the proper care of their equipment and of the traffic laws or ordinances in the city or state in which they are operating. These rules and regulations should be constantly brought to the attention of drivers, as practically all violations are caused by carelessness or thoughtlessness. To accomplish this a system of inspection should be put in effect so that all vehicles will be inspected once each month, giving particular attention to lubrication, tire inflation, cleanliness, body damages, radiator solution and condition of the battery. This inspection will disclose minor defects that should be given prompt attention, as minor defects, if allowed to continue, are likely to develop into expensive repair jobs. The changing of drivers from one vehicle to another should be eliminated as much as possible. When damage caused by abuse or neglect is discovered, the standing alibi is, "It happened before I got the truck." Drivers, too, pride themselves on the operation of their equipment, and quite naturally they would not be as interested in a piece of equipment that someone else had been operating.

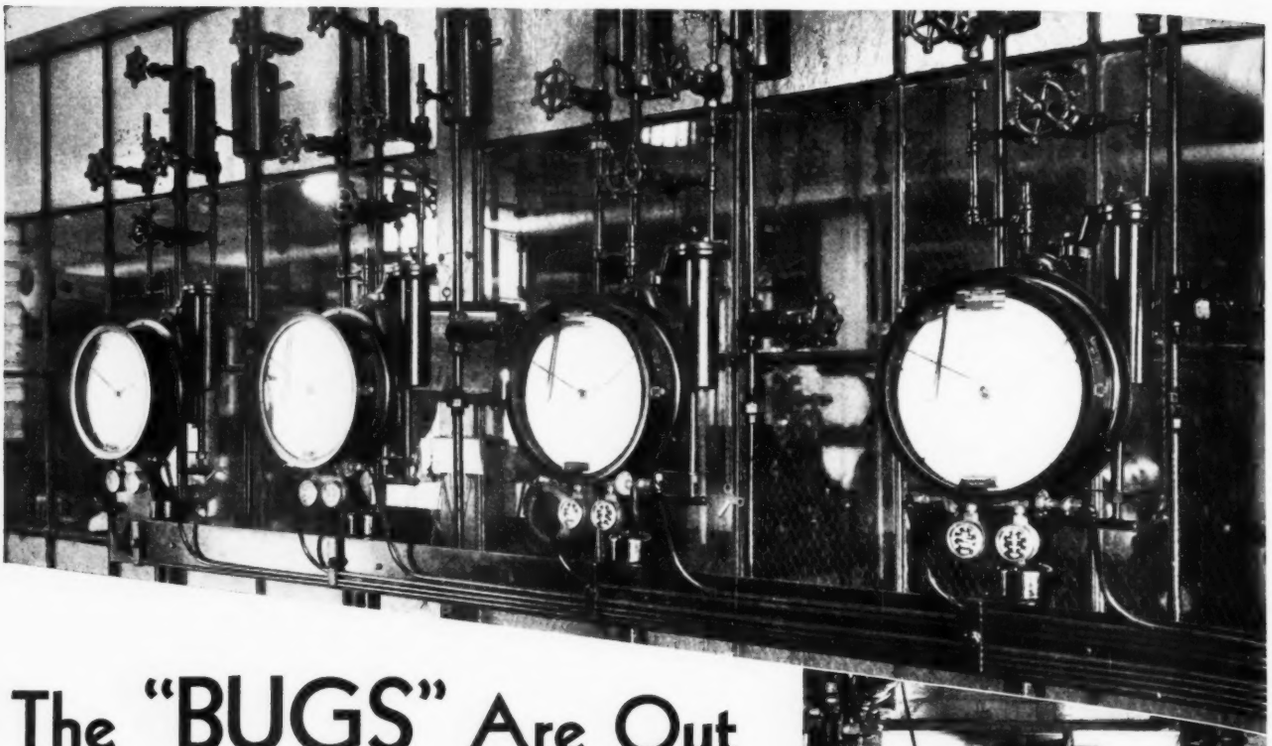
Interior view of paint shop at Oklahoma Natural Gas Corporation warehouse.



Hauling pipe for a gas line.

The operating expense of vehicles used in service work is usually higher than those used in other lines of work. They are sometimes idle a large percentage of the time during summer months, but during the most severe blizzards must be kept in operation practically twenty-four hours per day. During such rush periods they should be driven into the service station once each day for check-up on oil, radiator solution and battery. This can be accomplished at the same time the car is being refilled with gasoline, so that no additional time is lost.

The operation and comparison of passenger and light commercial type vehicles should be on a straight cost-per-mile basis, while heavier commercial vehicles should be both on cost-per-mile and cost-per-ton-mile basis. It is not to be expected that a truck moving an average load of four tons will operate as economically on a straight cost-per-mile basis as one moving an average load of two tons. In the movement of material the heavy-duty trucks are operating in competition to the existing methods of trans-



The "BUGS" Are Out

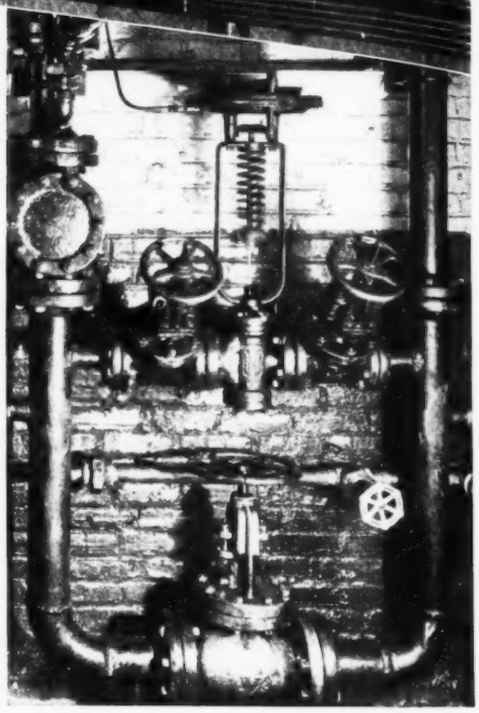
Over eleven hundred successful installations of Foxboro Flow Controllers prove this. They work—and with a minimum of attention. The experimenting stage was past six years ago. The experience gained during these years from hundreds of installations is yours for the asking.

Foxboro Flow Controllers have saved thousands of dollars and untold trouble for many refiners and producers, and *they can do it for you.*

They hold the control point *where you want it held* and accurately record the result. Look at the records on the Flow Controllers shown above! (They have not been retouched.)

The responsibility behind a Foxboro Flow Controller is not divided. These Controllers are a hundred per cent Foxboro built and serviced.

Foxboro is the oldest maker of Orifice Flow Meters as well as of Recorder-Controllers and it again takes the lead in Control Engineering with its V-Port Controlled Valves. Correct Controlled Valves are half the story of Flow Control. Write today for Bulletin 167-K, "Foxboro V-Port Controlled Valves."



A few of the many Foxboro Flow Controllers used by one of the large Eastern Refineries — and one of the V-Port Controlled Valves.

On one refinery process Flow Controllers tripled production.

FOXBORO
REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

THE FOXBORO COMPANY
Neponset Avenue, Foxboro, Mass., U. S. A.

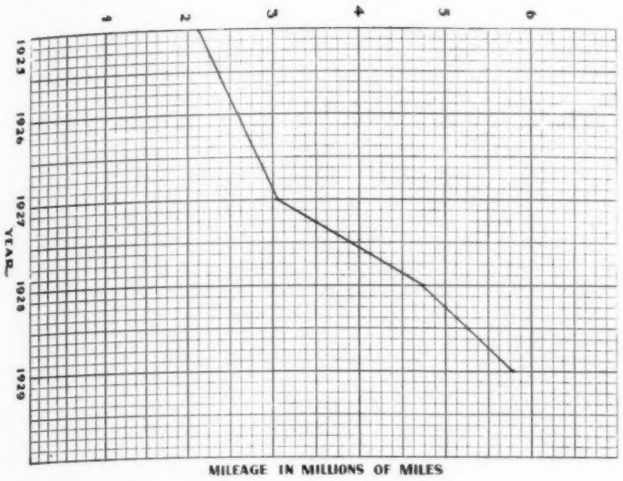
Agents for Robinson Patented Orifice Flange Fittings

28 North Guthrie Ave., Tulsa, Okla. Magnolia Building, Dallas, Tex.
J. E. Treacy, Strada Golesti No. 9, Ploesti, Roumania

New York Chicago Boston Philadelphia Pittsburgh
Cleveland Rochester, N. Y. Atlanta Los Angeles
San Francisco Salt Lake City Portland, Ore. Detroit

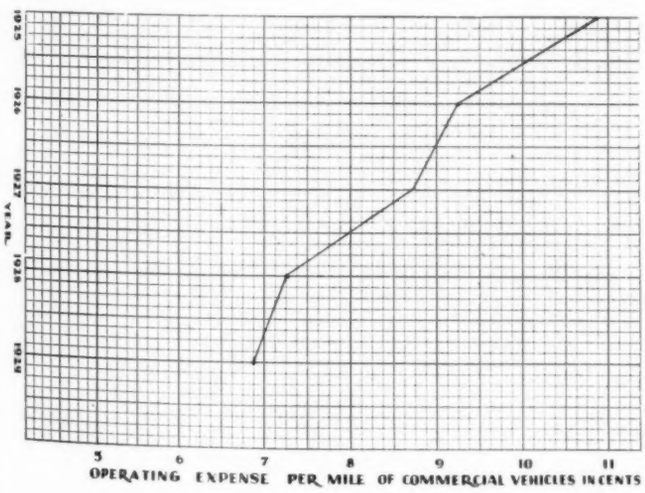
INSTRUMENTS *for* CONTROLLING, RECORDING, *and* INDICATING TEMPERATURE, FLOW, HUMIDITY *and* PRESSURE

When writing THE FOXBORO COMPANY *please mention The Petroleum Engineer*



portation, and where the saving of time is not a factor the costs of such transportation should be figured on a strictly competitive basis. It is not practicable to move bulk shipments of material between two railroad stations by truck where the distance is fifty miles or more. It often happens, however, that the material to be moved would have to be hauled several miles by truck to the nearest railroad and, on delivery, hauled by truck several miles to the location. In such cases the distance materials can be economically moved by truck is considerably greater, as this will eliminate the extra handling costs. Trucks used in construction work can be loaded with equipment upon completion of one job and moved to a new location a hundred miles away in a day's time, eliminating the delay of making freight shipments. This will reduce the overhead expense of construction crews and result in lower costs of construction.

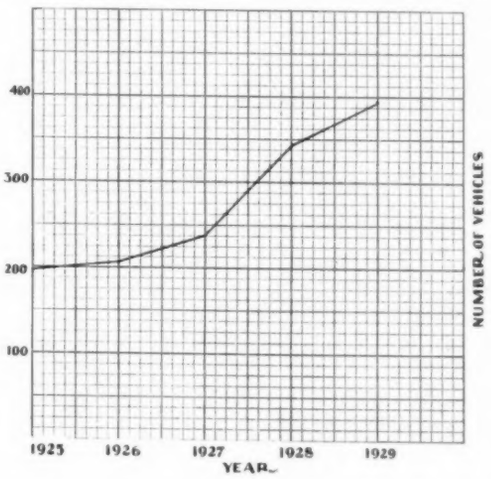
Very few business enterprises could show a profit if they were only in operation a small part of the year. This is also true in the operation of a fleet of trucks. Idleness of equipment of any kind costs money and results in higher cost of production. Construction work should be anticipated and spread as evenly over the seven or eight months of the year that are suitable for this work, eliminating as much as possible the high peak demand for equipment. The movement of surplus material from one location to another should be left for the time when ordinarily the trucks would be idle. Trucks should be routed so that they will be loaded over as much of their return trip as possible. During the rush of construction work when the demand is great, all service and minor repair work should be done at night, so that trucks will be available for full-time operation. Suitable loading and unloading equipment should also be



provided, so that they can be kept moving as much as possible.

The question of replacement is one that is always changing. The improvement in highways and mechanical construction of motor vehicles has raised our average replacement on passenger and light commercial vehicles from an average replacement at thirty thousand miles to more than forty thousand miles, and on heavy commercial types from fifty thousand miles to more than eighty thousand miles. All this has been accomplished in spite of the fact that our number of major repairs has been constantly reduced. It is not practical to make an unbreakable rule regarding replacement, but only by giving consideration to the present mileage, repairs necessary to put in operating condition, repairs previously made, probable allowance on trade-in, and the conditions under which the vehicle must operate can this be determined. It is quite often that a vehicle which would not give satisfactory service in hard field use can be economically operated for several months in light plant work. Medium weight trucks which are not in condition for general work can be equipped with carbide generators, air compressors, etc., at small expense and will give satisfactory service in this work for a long period of time, since they are not, as a rule, driven more than five hundred miles in a month's time.

However, a schedule of expected replacement, based on mileage, should be set up, and especially is this true since the almost universal adoption of budget control, where replacements and expansions must be seen and planned for months in advance. This should be followed as closely as practical, even though there will be cases where too much



money will be spent on maintenance. If this is not done it will be the careless driver who allows his equipment to run down who has the new car or truck.

There are a large number of advantages for the fleet operators to maintain their own garage and service station in locations where the number of vehicles to be repaired and serviced will warrant the investment necessary for a modern garage and equipment. If properly managed this should result in a considerable saving in the cost of making repairs. The drivers will be more thoughtful in the care of their vehicles if they know that in the case of a burned-out bearing or repairs of similar nature it will be necessary for them to explain to a company inspector how it happened. It will prevent unauthorized repairs. The problem of authorizing, checking and approving repairs made will be eliminated. Drivers will also feel more free to drive into a company-owned garage for check-up or minor repairs than they would if it was handled by an outside concern.

Continuous operation is necessary for a repair shop to show a profit. There may be a rush of work, followed by

a lull. Idleness may exist in very busy shops, such as a painter waiting for mechanical work to be completed before starting painting a vehicle. In our case this distribution of work is comparatively simple. Major repair work can usually be anticipated from two weeks to a month in advance. Our passenger vehicles and service cars get their hardest service during the winter months, while the commercial types get their hardest service during the summer construction periods. For this reason we try to do as much major repair work on commercial vehicles during the winter months as possible, and on passenger vehicles during the summer months. Vacation periods can also be used to an advantage in doing major repair work.

Improvements in the design of motor vehicles have been more numerous and revolutionary during the past four years than the combined changes made during the fifteen preceding years. Maintenance, too, has changed, and as a result many methods and ideas have been discarded. Modern vehicles are expected to, and do, run longer between major repair jobs. The present trend of maintenance is to devote more time to minor repairs and adjustments and less to major repair work. Putting brakes on front wheels changed the design of the whole front end. This also brought about need of adjusting or equalizing to produce the required amount of braking on front and rear wheels. Internal brakes with rigid shoes and clearances measured in thousandths of an inch require fine adjustment. Front-end alignment must be measured with close accuracy and equipment must be at hand for making minute adjustments and changes.

The old burning-in stand went out of date with the model T Ford. The present machined type bearings in high-speed motors require accurate clearances ample to provide for film of oil. To accomplish this with the required accuracy, all bearings should be line reamed. The present high-speed motors operate at higher temperatures, and as a result the radiator, water pump and thermostat require more attention. With high-compression engines, ignition timing is very important and must be checked by valve and piston timing rather than by observation of spark knock. Cylinder blocks are checked for roundness and taper by dial indicator gauges as close as one ten-thousandth of an inch. Pistons of different construction and materials require that clearances be checked with extreme accuracy. Replacing oil filter cartridges is a very important part of present-day motor service.

A battery and ignition man is a new addition to the modern garage. While it is not practical to build batteries, there are quite a number of battery repair jobs which can be done at times when there is no ignition or generator work in the shop. Painting and body repairs is another important item in fleet operation. Driver will take more pride in a vehicle that has a good appearance. On account of fumes and fire hazards it is better to have the paint shop in a separate building from that in which the general repair work is done. This building will need to be constructed so that a temperature of eighty degrees can be maintained in the coldest weather. A one-man paint shop should turn out two complete paint jobs per week in addition to numerous touch-ups and body repair work.

In order to maintain close supervision of the operation of all motor vehicles in a large fleet it is necessary to have a complete system of maintaining records of costs and performance. This is the only accurate method of making comparison of vehicles to determine the type or make to be purchased when replacement becomes necessary. However, on account of the various conditions under which they operate each vehicle must be given individual consideration, since it is obvious that it would not be fair to compare the expense of a vehicle operating in the Seminole field with one operating full time over paved highways.

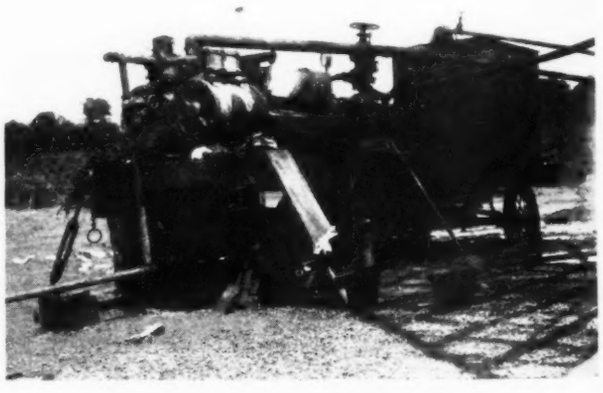
The difference in operating cost of one-fourth cent per mile seems a small item when applied to just one vehicle, but multiply this by hundreds of vehicles, covering thousands of miles every day, and it can be readily seen that it is of utmost importance for the fleet operator to maintain an accurate system of cost accounting. The monthly operating expense report should be given close study by the fleet manager and any excessive consumption of gasoline and oil, or any other unusual charges, should be investigated at once. An accurate tire mileage record should be kept, especially on the larger sizes, as this will not only give a picture of the service received from each tire but is also valuable when the question of adjustment arises.

The monthly inspection reports and the job record of all repairs made should go into the permanent record on each vehicle. This record is valuable to the fleet operator in determining if additional repairs would be practical or if the vehicle should be replaced. Each driver should be given a report on the monthly operating expense of the vehicle he is driving, as this is one of the best methods for calling to their attention the importance of giving their vehicle proper care. Not only this, but practically all drivers are interested in making a low mileage cost record and it is only fair that they should know what they have accomplished.

Portable Pump Overcomes Big Pressures

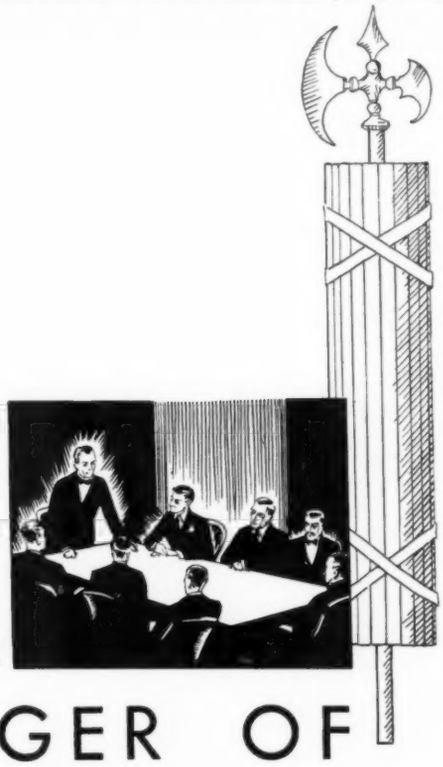
WHAT is believed to be the largest steam pump in the oil fields is used in the Oklahoma City field. "Big Bertha," as it has been named, is mounted on portable tractor wheels that permit it being moved about to various locations, where it has overcome many important difficulties.

It is used to kill and mud off producing wells that have sprung leaks in the Christmas trees. After the flow has been killed new Christmas trees are installed and the well returned to life. Several times it has been moved to difficult circulating mud jobs, or to free stuck drill stems. "Big Bertha" has been used in the field for more than a year, during which time it has with ease overcome many jobs that no doubt would have required much time and difficulty with a smaller pump.



The six-thousand-pound pressure portable pump.

Pressures in the Oklahoma City field run as high as 2300 pounds per square inch and often an old producer will have a pressure of 1800 pounds. It is against such pressures that the pump is often called upon to work. The big pump can easily build up 5,000 pounds of pressure with 100 pounds of steam, or about 6,000 pounds with 110 pounds of steam.



A MERGER OF ENGINEERING MINDS

Engineering minds, merged in the crucible of experience and dedicated to expert designing and construction at lowest possible cost, describes in brief, Whealton and Townsend service to the Petroleum Industry.

Beginning with scientific laboratory tests, this service carries on through all details of construction and ends only with the completed project put into operation.

WHEALTON & TOWNSEND, *inc.*

We guarantee cost, time of completion, quality of plant materials and quality and quantity of finished products.

"Save Through Skill"

LOS ANGELES, CALIF., SUBWAY TERMINAL BLDG. TULSA, OKLA., 120 BRADY STREET

Drilling Practices *in* Turner Valley[1]

By G. R. ELLIOTT*

FIRST let it be made clear that it is not the purpose of this paper to emphasize high speed in drilling. There is already too great a tendency to strive for speed and lose sight of more important considerations. Too much speed is the chief cause of crooked holes, is a prolific source of fishing jobs, and results in greatly increased wear on equipment. Notwithstanding all this, the speed of drilling is an important factor governing drilling costs, and operators, contractors, and stockholders should understand what constitutes efficient speed.

This article by Mr. Elliott contains an abundance of information concerning drilling methods in the Turner Valley field of Canada.

The following are legitimate questions which I will try to answer:

1. How long does it take to drill a well in Turner Valley and complete it in the limestone?
2. Is drilling speed increasing in Turner Valley?
3. How does the time compare with that in other fields?
4. Is there a difference between the various formations, as regards difficulty of drilling?

There are sixty-seven wells actually drilling in Turner Valley; of these, forty-two are standard cable, twenty-three are rotary, two are diamond. There have been many sweeping statements, some of them foolish, made on the relative merits of cable and rotary in this field. On the one hand: "This is not a rotary field, and never will be"; on the other: "Wait until the rotaries have had a real trial and they will eat it up." The first statement has been made in regard to almost every field where rotary has displaced cable; the second will have to be radically modified. It is not the intention here to present arguments one way or the other, but to submit facts, upon which anyone interested may base his own conclusions.

Progress Charts

To show actual speed data in graphic form, two parallel charts have been prepared. Chart A (Figure 1) represents the twelve wells which were completed in the limestone during the first nine months of 1929. Chart B (Figure 2) represents thirty-six of the wells which were drilling on October 1, 1929. These are depth-time curves, each of the vertical divisions representing 1,000 feet and each of the horizontal divisions representing three months. The following formation divisions are used for comparison: Benton, Blairmore (Dakota), Kootenay, Fernie, Limestone. Curves show only time during which work was being carried on; that is, they show fishing jobs or straightening operations, but not periods when work was suspended. More complete information is available for cable than rotary rigs, because the latter were in much smaller proportion previous to this year; as everybody knows, in Turner Valley, until a well is at least in the limestone, its history is difficult to predict.

CHART A—Three heavy lines make up the principal part of the chart, but close examination may reveal a network of fine lines. The fine lines are the 12 depth-time curves of the individual wells; they were drawn lightly in order that the average curves might stand out prominently. In any case, it would be too involved to follow individual curves. These individual well curves are based on progress charts maintained by F. K. Beach.

Table A summarizes the information on which Chart A is based. In the third column are found the average depths to the various formation contacts, and the formation thicknesses; these are plotted on the chart as the very heavy middle line. As an example of what a wide range is represented by each of the formation points on the average curve, the final position of each of the twelve wells is marked by a numbered square or circle and an arrow. The squares mark standard cable, and the circles mark rotary. It is apparent that the steeper the curve the faster the drilling time. Perhaps some of the more prominent horizontal portions of the individual curves may be discerned; these, of course, indicate periods when no footage was made; they are usually due either to fishing or cementing a caving hole. There is an extremely wide variation in the depths at which the various formation contacts were found in individual wells, and this situation in itself, of course, is sufficient to cause the great differences in the drilling times to these contacts.

CHART B—To make up Chart B, 36 drilling wells are used. These include nearly all those for which the depth

[1] Delivered before the Canadian Institute of Mining and Metallurgy.
* Petroleum Engineer, Department of the Interior, Calgary, Alta.

TABLE A

	Depth (feet)			Time (days)		Formation Time	
	Least	Greatest	Average	Fastest	Slowest	Days	Feet per day
Thickness of Benton	.....	.....	2,277	.....	.....	99	23
Depth to top of Blairmore	1,460	3,560	2,277	31	182	99	....
Thickness of Blairmore	.....	....	1,132	.....	.....	104	11
Depth to top of Kootenay	2,400	4,470	3,409	56	392	203	....
Thickness of Kootenay	.....	.....	472	.....	.....	29	12
Depth to top of Fernie	2,700	4,794	3,881	70	427	232	....
Thickness of Fernie	.....	.....	676	.....	.....	70	10
Depth to top of Limestone	3,220	5,345	4,557	98	483	302	....
Thickness of Limestone penetrated	.....	.....	275	.....	.....	113	2
Total depth	3,656	5,507	4,832	175	560	414	....

TALK NUMBER SEVEN BY A PROMINENT DISTRIBUTOR

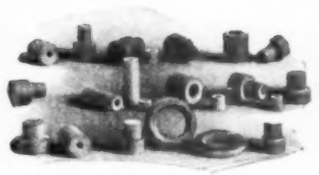
"Make Our Warehouse YOUR Warehouse

REPUBLIC SUPPLY CO.
THESE ARE TYPICAL OF 25 OTHER REPUBLIC SUPPLY COMPANY STORES
REPUBLIC SUPPLY CO.
GUMBO BUSTER MACHINERY

Above—Mr. J. H. Brooks, Vice President of the Republic Supply Company of Houston, Texas. This company's services are of a definite economic value to the prosperity of its business territory.

OUR WAREHOUSE properly used will save you, the consumer, payroll expense. Even when space is available some one must be in attendance to maintain order and check merchandise items in and out of stock. With us it's a matter of daily work, and wherever the functions are duplicated, waste effort is the result.

If consumers would use us more our services and prices would become even more attractive. We recommend Republic's Belting—Hose—Packing—Molded and Lathe Cut Goods."



The above statement is characteristic of those made by prominent distributors all over the country. It explains in part how the Industrial Supply Distributor, helping to solve the important problem of broad markets and economical distribution, upholds high quality, maintains fair prices and saves needless efforts on the part of both consumer and manufacturer.

Republic has had many years experience in developing molded goods for nearly every known purpose. This experience, plus sufficient equipment to handle all kinds and sizes of material promptly, is your best reason for submitting your molded goods problems to Republic's representatives.

THE REPUBLIC RUBBER CO.

Youngstown Ohio

REPUBLIC means the Best Mechanical Rubber Goods

to any of the principal formation contacts is available. The 36 wells consist of the following groups, each of which is represented on the chart by a curve:

7 Standard cable drilling below the top of the Limestone	Curve 1A
2 Rotary drilling below the top of the Limestone	Curve 1B
4 Standard cable drilling below the top of the Fernie	Curve 2A
2 Rotary drilling below the top of the Fernie	Curve 2B
2 Standard cable drilling below the top of the Kootenay	Curve 3A
1 Rotary drilling below the top of the Kootenay	Curve 3B
10 Standard cable drilling below the top of the Blairmore	Curve 4A
8 Rotary drilling below the top of the Blairmore	Curve 4B

Is Drilling Speed Increasing?

Represented by Charts A and B and the corresponding Tables are five groups of wells. The first includes wells completed in 1929 previous to October 1st; some of this group were started as early as the latter part of 1927. The other four groups, shown on Chart B, bring us progressively down to the latest group, which includes those commenced as late as three months ago. Some of these groups are made up of rather few wells for a reliable average figure. The following is a tabulated comparison of the footage per day for cable tools:

Benton	22	17	26	21	26
Blairmore	10	10	8	60	
Kootenay	10	20	13		
Fernie	8	6			

The only striking increase in speed is that in the Blairmore; the last group includes the two fastest standard outfits in the field. No consistent speed trend is apparent in any of the groups. Below are tabulated the rotaries in the same way:

Benton	25	35	48	52	44
Blairmore	27	27	55	26	
Kootenay	16	28	29		
Fernie	16	13			

The drilling time for the Benton and Kootenay shows a distinct trend toward greater speed. The fifty-five figure in the Blairmore division means very little, as in only one well of this group was the top of the Kootenay located. More rotaries than formerly are being drilled by contract. This is partly responsible for the increasing drilling speed in the Benton group.

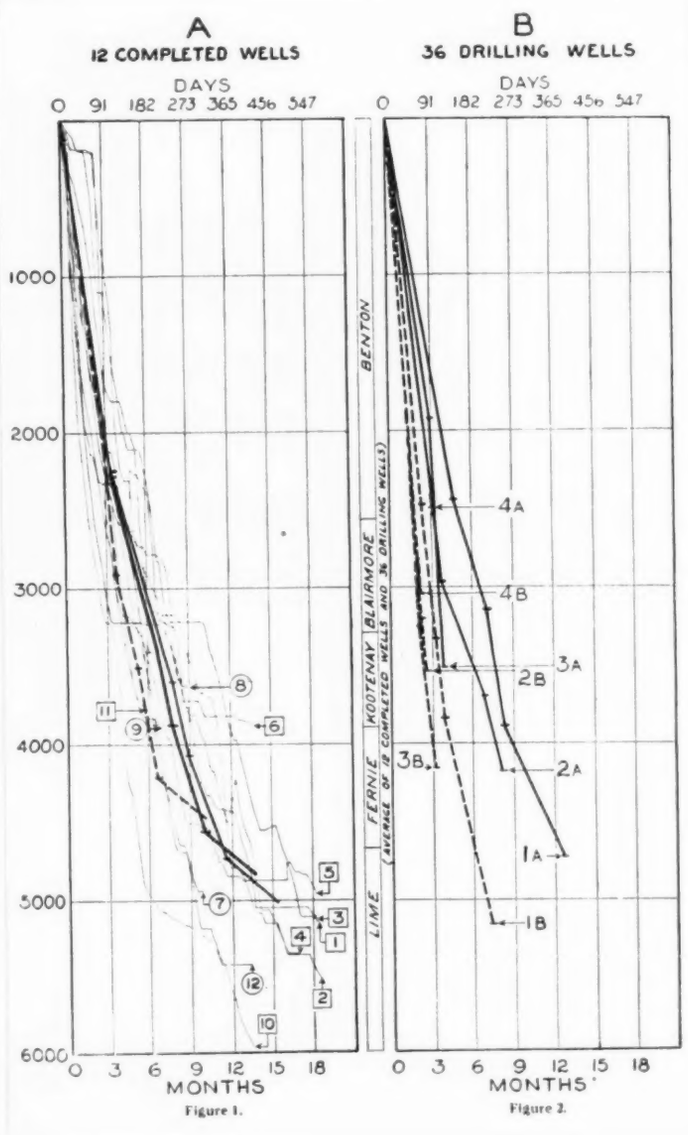


Figure 1. Figure 2.

Other Fields

Before further discussion of Turner Valley, a brief comparison will be made with some United States fields. In order, intelligently, to compare drilling speeds in Turner Valley with those in proved fields elsewhere, it is necessary to assume that the only horizon worth considering is the Limestone—and this assumption is not by any means justified. The speeds referred to for southern fields are for rotaries in districts where the oil horizons were already located and very little coring was necessary. Kettleman Hills is one of the most difficult fields in California, and resembles Turner Valley in its high pressures and high-gravity oil. Until the productive horizons were defined, some slow drilling speeds were recorded Two dry holes averaged more than two years to drill 6,000 feet The present wells encounter the following difficulties: loss of circulation at depths down to 2,000 feet; from about 5,000 to about 6,300 feet, gas pressure combined with a cavey shale; a strong flow of water at 5,300 feet (flowed up through the drilling mud and built up a closed-in pressure of 1,800 pounds). Wells commonly drill to a depth of 5,000 feet in 60 days, but take 200 days to complete at about 6,600 feet. In the Seminole field, Oklahoma, the programme is to set about 3,900 to 4,100 feet of 8¼-inch casing and then drill-in 400 to 500 feet with cable tools; the time averages 60 to 70 days. In the Oklahoma City field, wells are commonly completed to 6,500 feet in 60 days and average about 100 days. The average speed to drill to 5,000 feet in these fields is much less than the fastest time made by any of the twelve completed wells tabulated in this paper.

One accustomed to visiting rotary wells in California immediately notices a striking difference in Turner Valley. In most California fields, as one goes from well to well, comparatively few of the wells are 'in the hole' drilling, but the greater proportion are 'coming out' or 'going in'. In Turner Valley, the converse is true, in most cases the wells being found with the drill pipe rotating on bottom. This is sufficient to indicate that the formations are harder and rock bits are being used.

In California the fish-tail is extensively used, particularly down to about 4,000 feet; at greater depths, rock bits are frequently used to drill through 'hard shells'. In Turner Valley, very little of even the upper shales and sands can be economically drilled with the fish-tail.

The difference is not so marked between Turner Valley and Oklahoma; the rock bit is used almost as extensively in the latter fields as in the former. In both regions there are plenty of hard indurated sandstones, and they drill at about the same speed. In Turner Valley, the unusual slowing down appears to be caused largely by the large amount of 'tough' shale; that is, the formation is not brittle enough for a rock bit to cut well, and is not soft enough for any other bit to drill.

REFINERIES SAVE WITH THIS NEW RETURN BEND

The special features of these fittings are covered by Patent Application No. 315274, Oct. 26, 1928, series of 1925. Method of attaching these fittings onto tubes, by means of a jig, is covered by Patent No. 1746535.

WHEN time means money, and both can be saved by the use of Key Sectional Type Stream Line Flow Return Bends—

—it becomes a duty to learn what these fittings accomplish for the operator of tube or pipe stills.

The separable feature of this return bend allows replacement of single tubes without the loss of others. Quickly dismantled, it provides a saving in time when cleaning tubes. Its design guarantees a minimum pressure drop through the return bends of approximately 25%.

The construction is forged steel throughout, except the cast steel U-bend. This being the only part subject to extreme wear, it may be replaced while leaving the rest of the fitting intact.

The Key Sectional Type Stream Line Flow Return Bend is universally applicable to every kind of tube or pipe still, and to all operating temperatures and pressures. It is adapted to very close spacing of tubes.

A request will bring full information about the entire line of Key Refinery Fittings.

We are always ready to produce special fittings similar to the 7-tube inlet manifold header shown above, to meet the requirements of unusual operating conditions and still construction.

KEY BOILER EQUIPMENT CO.

EAST ST. LOUIS, ILL., U.S.A.

Speed in the Various Formations

For both cable and rotary systems, the Benton is definitely the easiest formation to drill; this is more marked in the case of cable tools. The rotary speeds decrease in order from the top down—Benton, Blairmore, Kootenay, Fernie; this appears to indicate that the most important factor is the decrease in effective drilling time, due to greater time occupied in pulling out and going in again as the hole gets deeper. With the cable system, of course, the time required to change bits is comparatively small, being a matter of minutes instead of hours. The slowest time for both systems is made in the limestone. This is partly due to the hardness of the rock, but also largely because of the protective measures employed against the well 'blowing in'. For both systems also, the Fernie is the next slowest. In cable holes, caving in the Fernie necessitates considerable cementing. The Kootenay shows more rapid drilling than the Blairmore in cable records, but apparently the rotary rock bit does not meet with more resistance in one than in the other.

One of the important differences between cable and rotary is that, in the cable system, no different type of bit is required for hard than for soft drilling. Patterns vary as to shape of shoulder, and a new shape is twisted a quarter turn to assist in keeping a straight hole. The type of bit employed depends on the driller's preference, and the same bit may be dressed for hard or soft drilling. A sharper wedge is left for hard drilling and a more blunt and round shape for soft drilling; a very sharp V-shape is believed to tend more to crooked hole than the flatter shape.

The rotary system employs many types of bits. These include the common fish-tail type; disc bits of several makes; bits with changeable cutter blades, and rock bits, using cones and rollers. Most types and makes of rotary bits have been tried in Turner Valley to some extent, but not all have been thoroughly tested.

Of course, the most important factor in determining speed with either system is the judgment of the superintendent. This is, perhaps, particularly true for cable tools, where it is continually necessary to choose between drilling open hole and carrying casing. The first frequently necessitates cementing to prevent caving, and the second involves the slow operation of underreaming. Balancing these two situations is a problem requiring good judgment and experience. The examples of particularly fast time for cable tools are instances where open hole could be drilled for a considerable distance without caving.

Summary

Based on twelve completions this year, drilling time varies from six to eighteen months, with an average of over one year. Present indications point to a reduction in the six months minimum and also a lowering of the average time.

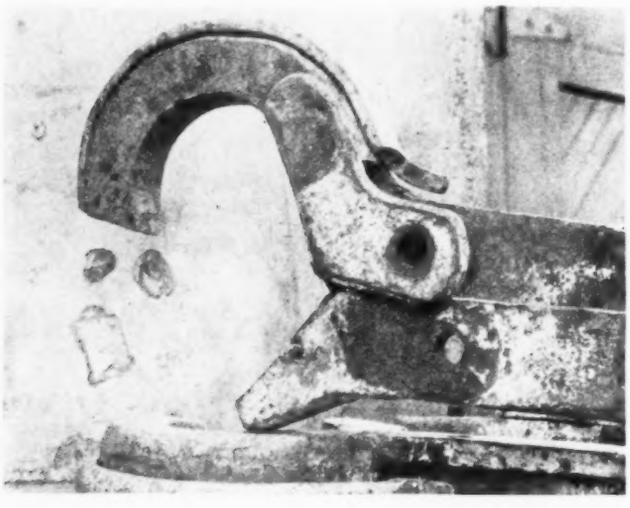
Drilling time is approximately twice as long as in the principal United States fields; the character of the formations is the chief cause of the slower speed.

In either cable or rotary systems, the difference in the various formations has not as important a bearing on drilling speeds as has efficiency of operation.

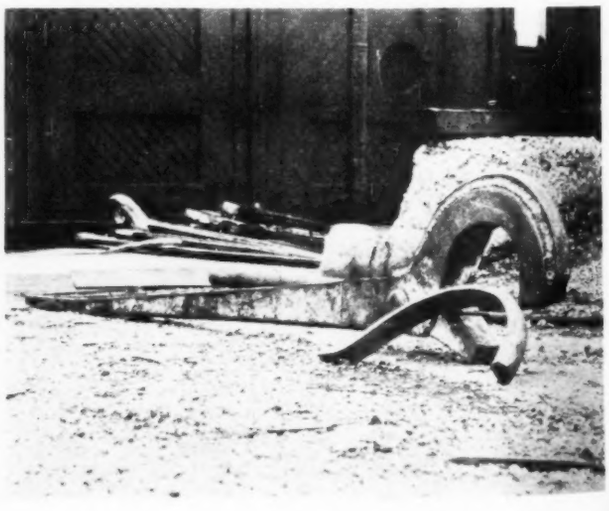
Repairing Pipe Tongs in the Shop

RAPPING bailing wire around pipe tongs which have been sprung is a practice that is rapidly disappearing. Pipe line contractors and companies make periodical check of this equipment and when in need of repairs it is sent to the shops. It is a practice for Oklahoma Natural Gas Corp. field crews to mark tongs which are found to have been sprung and send to the company's shops. There they are heated and reset and made stronger with a reinforcement strap welded on.

Some of the tongs received at the shops have been found to be as much as three-sixteenths of an inch out of line. In addition to being reset the equipment generally needs to be rebuilt to some extent and this is also done at the shops.

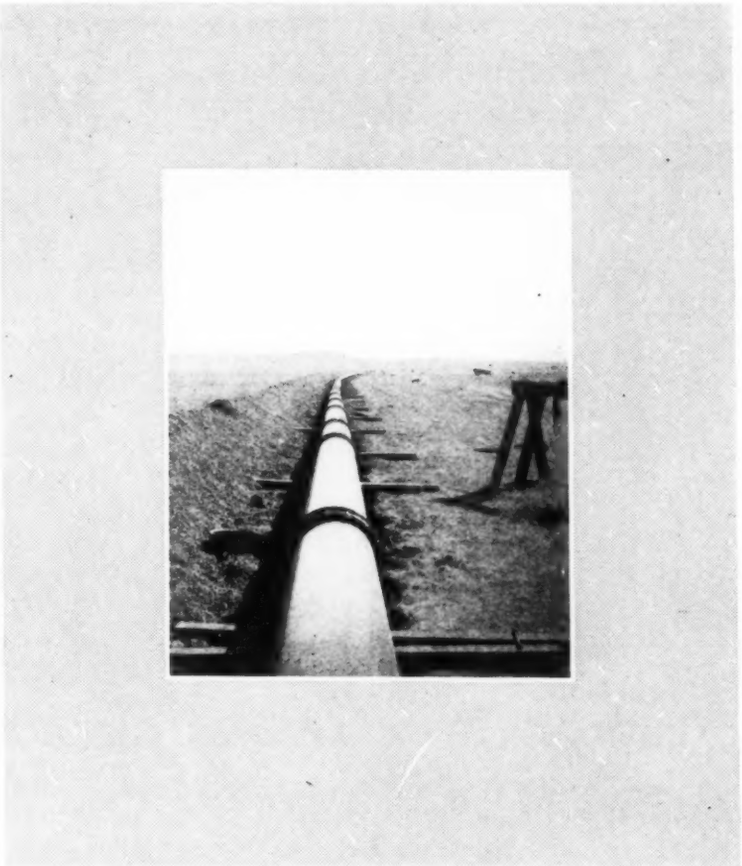


Reshaped tong with redrilled bolt holes ready for final work.



Completely repaired tongs with reinforcement strap at the side.

CONSTRUCTORS OF PIPE LINES OF ANY SIZE, TYPE OR LENGTH



SCOPE OF OPERATIONS 1929—

OIL LINES

Empire Pipe Line Co., 35 miles 8″
Texas Empire Pipe Line Co., 415 miles 12″
Texas Company, 25 miles 8″

GAS LINES

Interstate Natural Gas Co. (Loops), 85 miles 22″
Southern Gas & Fuel Co. (Loops), 23 miles 18″
Mississippi River Fuel Corp., 214 miles 22″, also 25 miles 16″
Mississippi River Fuel Corp., 100 miles Laterals
Southern Natural Gas Corp., 218 miles 22″
Southern Natural Gas Corp., 100 miles Laterals
Arkansas Natural Gas Corp., 135 miles 20″

PIPE LINE CONTRACTORS
Williams Brothers Inc
ENGINEERS CONTRACTORS

In addition to the above we constructed for these companies 80 miles of River Crossings under the Mississippi, Missouri, Illinois, Red, Arkansas, White, Black, Yazoo, Ouachita and Warrior Rivers.

The facilities of this organization are ever increasing for efficient service in pipe line construction in all its phases.

Williams Brothers, Inc.

PIPE LINE CONTRACTORS

Exchange Bank Building **Tulsa, Oklahoma**

When writing WILLIAMS BROS., INC., *please mention The Petroleum Engineer*

I. T. I. O. Has

Model Company Field Warehouse

ONE of the largest, best-stocked company-owned field warehouse and yards in the country is the Indian Territory Illuminating Oil Company's at Oklahoma City. It is also one of the most model in layout and accessibility.

The unusually large number of operations of this company in the Oklahoma City pool has been responsible for the installation of such a large, fully equipped warehouse. Since the active drilling development of the field started in a big way, this company has had more than 100 drilling wells at all times and more often nearer 200, in addition to its producing wells, plants and lines that must be cared for.

It is one of the busiest spots in the entire Oklahoma City field. Trucks are constantly going and coming from the field. Every piece of equipment used by the Indian Territory Illuminating Oil Company in the field comes through these yards before going into the pool. Many millions of dollars worth of equipment and material have passed through the warehouse or its yards. The stock kept on hand also runs to very high figures. Some idea of the tremendous amount of activity surrounding the place can be gleaned from the fact that more than 300 carloads of material were handled during the month of April.

The big warehouse has proven very economical. It has not only enabled the company to keep a large supply of material on hand, but has been a saving in time in getting equipment to the various wells in the field. Thus little lost time has occurred from waiting on equipment.

It is ideally located. Alongside the back runs a railroad. A number of sidetracks permit spotting of shipments. The yard is also easily accessible to any point in the pool, lying along the southwest edge of production, where roads lead to any part of the field.

Inside the yards a number of spurs have been laid from the tracks. Several run up through the portion of the yard devoted to pipe and casing, each track can accommodate four or five cars. Gin poles are set at advantageous positions to aid in handling the bigger equipment.

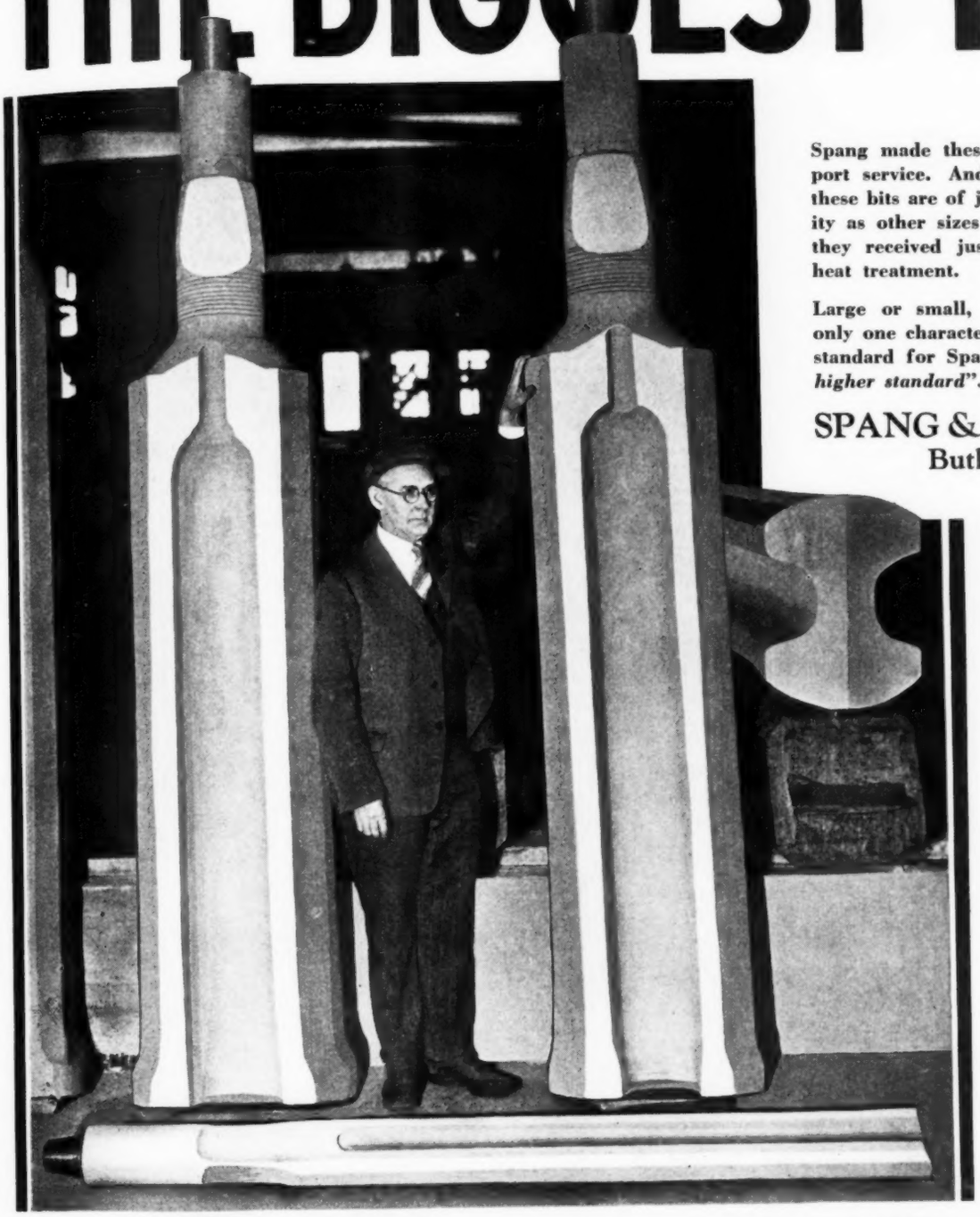
The entire yard covers nearly two city blocks, with practically every bit of it pressed into service. A large building in the center has offices in the front, with the back part for fittings and other small material. Back of this building is a shed where countless valves and other medium-sized equipment are stored. Such equipment as pipe, casing, sand, gravel, etc., are stored in the open.

A large office force is maintained to check the material in and out of the warehouse yards. Transfers are issued here before any material is taken to the field. A large crew of men are also employed on the ground, under the direction of Ben Hopkins, to load the trucks and unload the train cars.

The warehouse is under the supervision of W. R. Heywood, storekeeper of the Oklahoma City warehouse. It is in the Southern Oklahoma division of the company, of which J. W. Harwood of Seminole is division storekeeper.

Top to bottom—W. R. Heywood, storekeeper, and J. W. Harwood, Southern Oklahoma Division storekeeper. The office building; warehouse behind. Portion of the pipe yard. A few of the many valves. Chat and sand piles.

THE BIGGEST YET



Spang made these large bits for export service. And big as they are—these bits are of just as splendid quality as other sizes of Spang bits, and they received just the same careful heat treatment.

Large or small, Spang Bits are of only one character as to quality. The standard for Spang is distinctly *"the higher standard"*.

SPANG & COMPANY
Butler, Pa.

SPANG

The HIGHER STANDARD

WELDLESS JARS

Station Pumps Utilized for

Grinding Intake *and* Exhaust Valves

GRINDING intake and exhaust valves at pipe line stations which are not equipped with power devices to do this necessary work is frequently a job entailing considerable grief and one not always done to the satisfaction of the station engineer. In such cases the valves are usually ground by hand and the type of completed job depends largely upon the man doing the work.

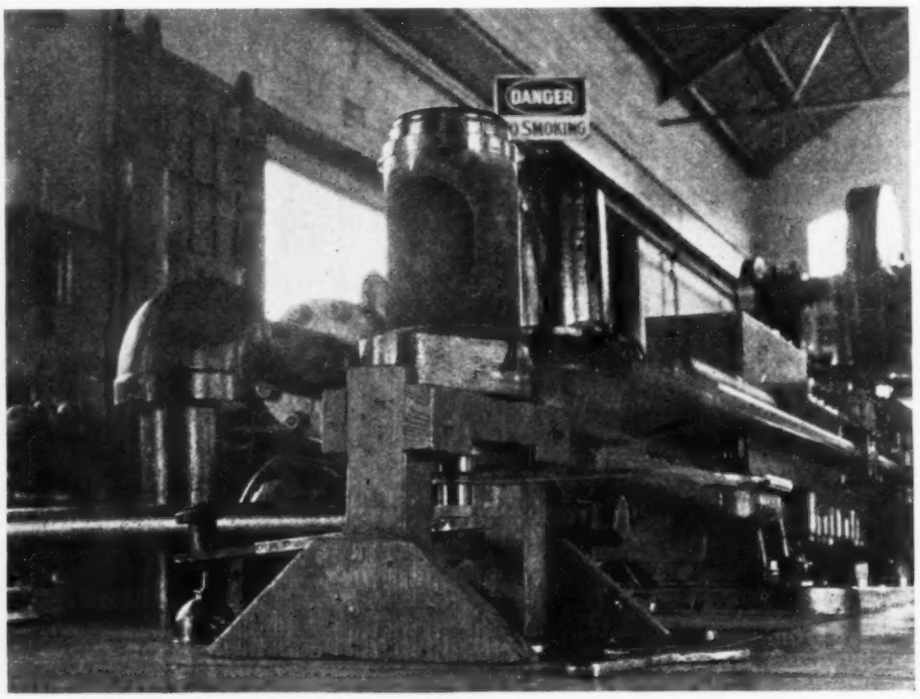
At some stations one or two members of the crew have taken an interest in this work and have become more or less expert at the tedious task. At the majority of stations where valve grinding is done by hand it is practically impossible to get a man to give the desired attention to the job which requires four to five hours, depending on the condition of the valve and seat.

Under these conditions it is difficult to get valves ground properly. Such jobs not only lower the efficiency of the equipment when the valves are not seating properly, but lead to more frequent grinding and a more rapid rate of replacement.

In many instances it is not entirely the fault of the crew member that a grinding job is not completed satisfactorily. Sometimes the cradle holding the valve tilts to a small degree, unnoticed, with the result the operator does not apply pressure uniformly. Other times he may be working in quarters not suitable for the work.

More often, however, it is a case of a crew member working carefully for two or three hours and then becoming impatient. Consequently he tries to hurry the job to a point where the grinding becomes uneven.

To get away from the several evils traced to grinding valves by hand, mechanics and station engineers have designed devices to do the work mechanically. Some utilize shop machinery at stations by employing special rigging for the equipment. At stations where there are no shops, devices for grinding valves have been designed to operate from pumping units.



Machine connected to pump cross-head shoe. At left, pedal for raising valve.

At the Sinclair Pipe Line Co.'s Bowie, Texas, station is a device which is used to grind valves. It is similar to those found at many other of the company's stations. The valve is held in a cradle and the stem is connected with a rod to the rear cross-head shoe of a horizontal reciprocating pump which turns the valve one third of a turn with each stroke. After the device has been set up, its operation is simple.

With this a satisfactory valve grinding is completed in four or five hours. No one member of the crew is required to give constant attention to the job, therefore that man's service is not lost at a time when he is needed. The only attention necessary by this method is for someone to raise the valve and stem, to apply grinding compound and lubricating oil, which requires only a few moments.

The cradle may be built with wood or metal. In this instance the cradle is made of wood given greater rigidity by the use of bolts. It is built high enough so that the rod connecting the valve stem to the cross-head shoe is approximately parallel to the cross head. A pedal lever is included in the frame with one end directly under the valve stem and the other protruding outward. This permits raising the valve high enough to put new compound on the valve seat and lubricate it during grinding.

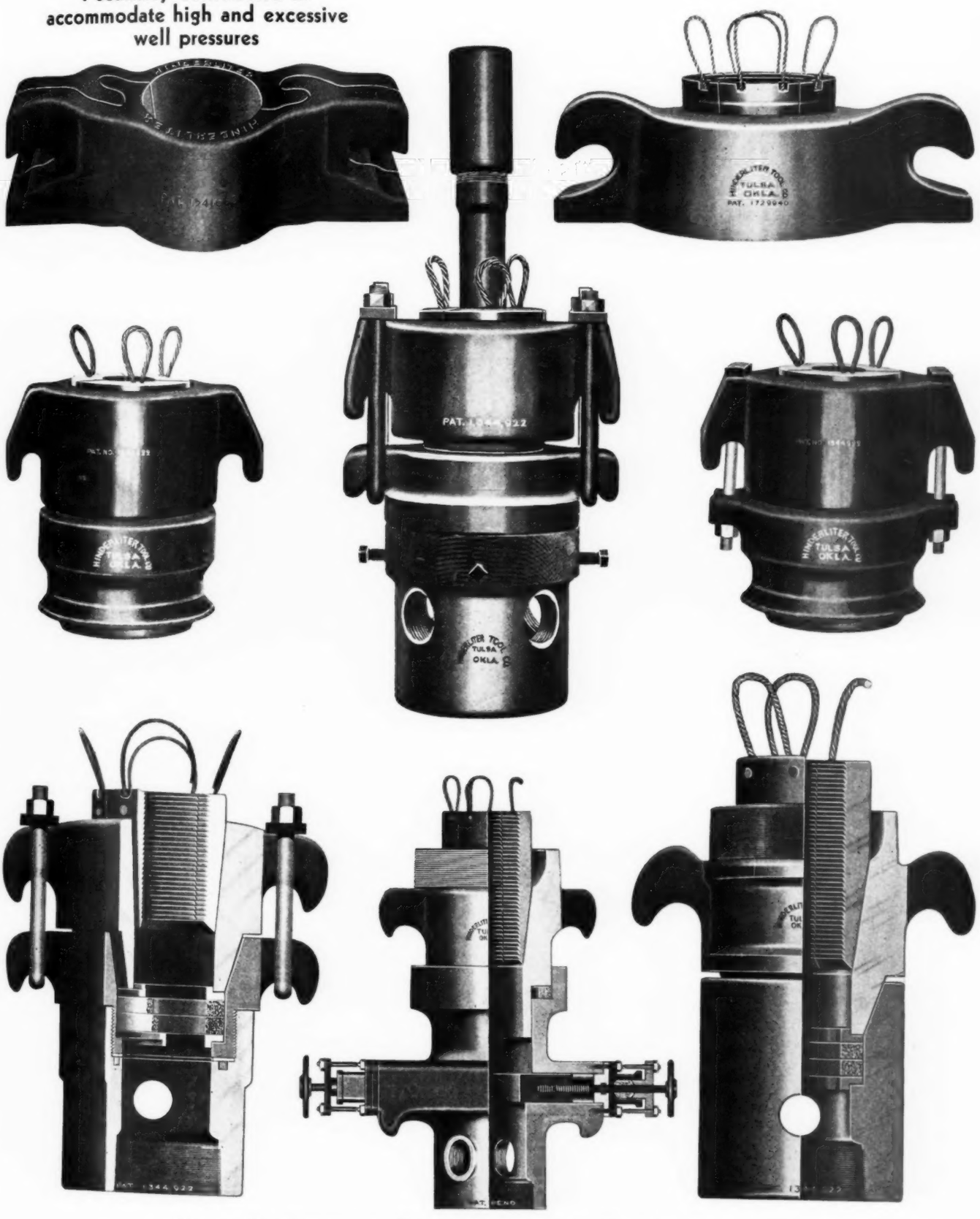
The connecting rod slips over the valve stem and is tightened with a couple of nuts and extends outward to connect with the rigid rod fastened to the cross-head shoe. The connecting rod may be made with any light but sturdy metal.

One important feature of this method is that the pressure of the valve on the seat is uniform because only the weight of the valve and stem is applied to the seat. In case of a badly or unevenly worn valve and seat the device apparently is grinding away the higher or ridge surfaces first and so far has not caused grooving.

Patented Casing Tools and Hook-up

By HINDERLITER

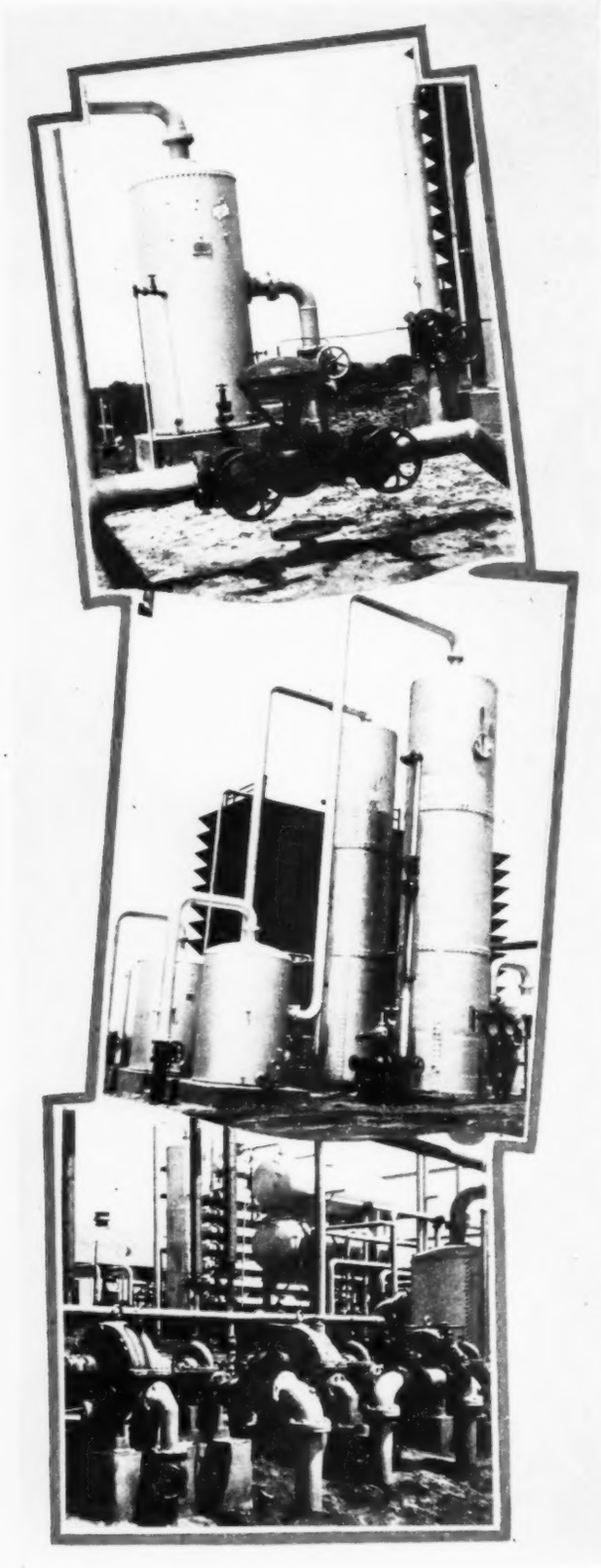
Peculiarly constructed to accommodate high and excessive well pressures



When writing HINDERLITER TOOL CO. *please mention The Petroleum Engineer*

Model Gasoline Plant in Konawa Field

By ANSON W. DWEN, *Vice-President, Crosbie and Moran, Inc.*



Top to bottom—Pressure control instruments. Absorbers in the Crosbie-Moran plant. Water pumps in the Konawa plant.

THE gasoline plant of Crosbie and Moran, Inc., located near Konawa, Oklahoma, is now processing about about 6,000,000 cubic feet of gas daily through the compressors and approximately 10,000,000 cubic feet of gas daily through well pressure and a separate absorber. This plant started operating April 1st, of this year. It is of the absorption type, and a portion of the stripped gas is compressed to fifty pounds pressure and put back into the residue gas lines to assure a constant volume and pressure to the numerous drilling wells in the field.

The distillation capacity of the plant with its present installations is 30,000 gallons daily with every possible allowance made for additional capacity to be added without a shutdown of any sort. The management is seriously contemplating additional capacity in order to cope with the rapid expansion of the field. The plant at present is producing an average of 15,000 gallons of Grade B gasoline daily. A stabilizer is being installed to produce Grade AA gasoline. The present production meets the doctor and corrosion tests without treatment, although an extensive treating plant is installed and ready for instant operation, should the processed gasoline demand such treatment.

The most modern equipment has been installed. The distillation unit, absorbers, stock tanks, accumulators, tank, etc., have all been equipped with automatic pressure and temperature controllers, and recording temperature and pressure instruments.

There are two bubble type absorption towers in use and operated under 35 pounds pressure. These are equipped with level and pressure controls and temperature and volume recorders, and have scrubbers on the gas inlet and outlet.

The compressor installation to handle the incoming gas, consists of six 165 h. p. and two 200 h. p. gas engines. They compress the gas to forty pounds.

The cooling medium is of the latest design, aiming at efficiency and ease of operation. All cooling of gas, oil, vapor, and dephlegmator water is by the atmospheric water cooling system.

An unusual boiler installation is to be found in this plant. The boiler house contains three 125 h. p. Scotch marine type boilers, operated at 165 pounds pressure, capable of 200 per cent overload. These boilers are automatically controlled from the feed water to the residue gas with which they are fired. They have several unusual and highly efficient features in that they have seventy-foot stacks, allowing of great draft, and all water is run through a feed water heater before being pumped to the boilers.

Water for the plant is obtained from two wells 550 feet deep, being flowed and pumped from the well to the 1600-barrel tank erected on a specially constructed base. The water then gravitates throughout the plant to its various points of usage.

Centrifugal pumps with turbine drives are used for all water and oil circulation, the used steam being disposed of in two ways part of it being super-heated and used for agitation in the still, and the balance put through the feed water heater and what fails to condense there is condensed in a spray pond especially constructed for that purpose and to catch all waste water from the plant.

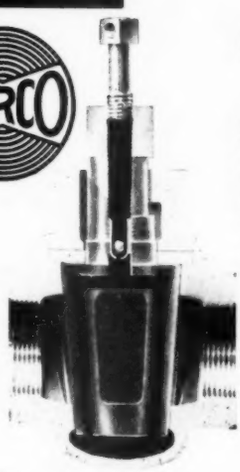
Cup grease NEVER used

SPECIAL "MERCO" LUBRICANT IS *recommended*

It is highly important that Nordstrom Valves be kept thoroughly lubricated with the proper "Merco" Lubricant to help them function properly. **Cup grease should never be used** because Nordstrom Valves are used in many different kinds of services — each of which requires a special "Merco" Lubricant carefully compounded to withstand the conditions of the service. The present "Merco" Lubricants are the result of 12 years of constant research and when properly used in Nordstrom Valves assure the most efficient valve service.

Our latest Catalog shows in detail the proper "Merco" Lubricant for your particular service. Or our engineers will gladly recommend the "Merco" Lubricant best suited to your requirements.

To lubricate the Nordstrom Valve, simply remove lubricant screw and insert "Merco" Lubricant stick of proper size. Replace lubricant screw and turn down. Valve should be opened and closed several times while inserting lubricant to distribute lubricant evenly around plug and to properly seat the plug.



MERCO

MERCO NORDSTROM VALVE COMPANY

Subsidiary of The Merrill Company - Engineers

Atlanta—Healey Bldg.
Boston—184 Boylston St.
Buffalo—Genesee Bldg.
Chicago—176 W. Adams St.
Dallas—Magnolia Bldg.
Detroit—2842 W. Grand Blvd.
El Paso—111 S. Virginia St.
Houston—Petroleum Bldg.
Los Angeles—556 S. San Pedro St.
New Orleans—Masonic Temple Bldg.
New York—11 W. 42nd St.
Pittsburgh—Clark Bldg.
St. Louis—317 N. Eleventh St.
San Francisco—343 Sansome St.

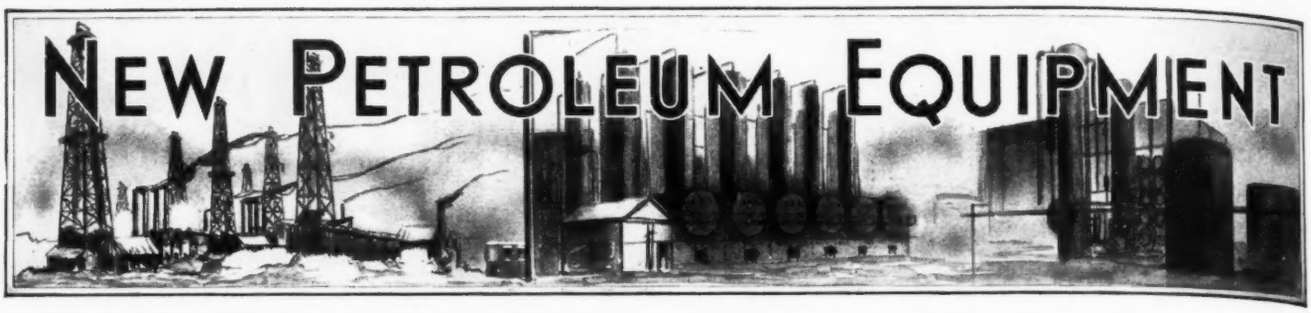
AGENCIES:

Denver—Republic Supply Company, 332 Continental Oil Bldg.
Honolulu—W. A. Ramsay Co., Ltd., Fort and Queen Streets
Manila—E. W. Sharpe, Perez Semanillo Bldg.
Saginaw—Arthur C. Beckert, 112 Durand Street
Salt Lake City—National Equipment Co., 101 West 2nd South St.
Tulsa—B. V. Emery & Company, 216 E. Brady Street
Philadelphia—Brown, Wilson & Company, 1600 Arch St.

Factories in U. S.—Oakland, Calif., and Belleville, N. J.
Canada—Peacock Bros., Ltd., Montreal, Toronto, Winnipeg, Vancouver. (Also Sydney, N. S.)
England—Audley Engineering Co., Ltd., Newport, Shropshire.
Buenos Aires, Argentine—General Electric, Soc. Anon., Victoria 618 Esq. Peru.

THE PERFECT APPLICATION OF A PRINCIPLE

When writing MERCO NORDSTROM VALVE CO. *please mention The Petroleum Engineer*

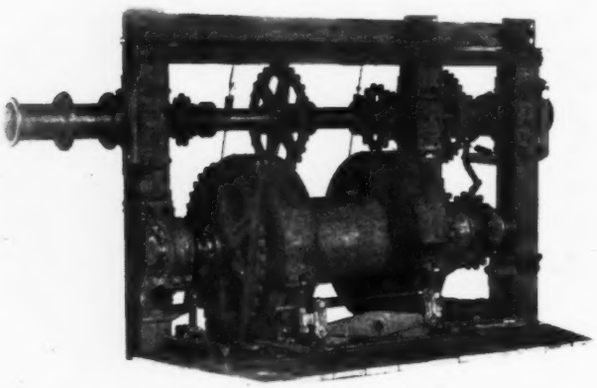


Brown Instrument Consolidates Offices

THE Brown Instrument Company, Philadelphia, Pa., announces the consolidation of its Chicago sales office and midwestern factory branch, in new quarters located at 155 East Superior Street, Chicago, Ill. Practically double its former space has been provided and a larger stock of replacement material is carried on hand.

New Extra Heavy, Three-Speed Roller Drawworks

THE Lucey Products Corp.'s new B-1700 Extra Heavy, Three-Speed Roller-Bearing Drawworks is designed for use in the deep fields where long strings of pipe must be handled.



The drum center and shaft is of patented construction. The drum center is cast around the forged steel shaft in such a manner that the two units form practically a one-piece unit. No keys or bolts are used, and it is impossible for the drum center to work loose on the shaft. The eight-inch diameter shaft is fitted with Timken heavy-duty roller bearings, mounted in self-aligning bearing boxes.

Drum flanges are the Lucey patented free expanding type —improved. An inner annular rib is machined to fit snugly against the face of the drum flange. This rib, together with a companion rib at the outer face of the drum flange, forms a trough for holding water when it is desired to cool brakes by water. The drum flanges are reinforced by a heavy support collar which is keyed into a recess in the shaft and which fits against the outside hub of the flange, thus eliminating the spreading of flanges during bailing operations.

All sprockets and clutches are of Lucelloy special analysis steel.

The brake mechanism is of advanced design, affording a fuller contact with the brake band. The new brake is simple to adjust, as it is necessary only to tighten or loosen adjusting nuts.

A spacer template is provided by means of which the derrick sill may be accurately drilled to receive the posts. The posts are mounted on this template which is made of heavy angle iron and acts as a lower tie which rigidly aligns the posts. A top tie plate, which is bolted to the front face of the posts at their upper extremity, rigidly aligns and ties the posts together. A floor plate between numbers one and two posts carries the clutch shifting and braking mechanisms.

The forged steel lineshaft is seven-inch diameter and fitted with double Lucelloy steel cathead. The post guards are equipped with SKF self-aligning ball bearings.

New Distributors for Tube-Turns

TUBE-TURNS, Inc., Louisville, Ky., announces the appointment of six new distributors of its seamless, short radius forged fittings for pipe welding.

The new distributors are the Grinnell Company, at Charlotte, N. C., for North and South Carolina and Georgia; Ebbert & Kirman Company, Inc., of Birmingham, Ala., for Alabama; the B. Hoffmann Manufacturing Company of Milwaukee, for Milwaukee and adjacent territory; the United Pipe & Supply Company of Charleston, W. Va., for Charleston and adjacent territory; the Vulcan Copper & Supply Company of Cincinnati for Cincinnati and adjacent territory, and Hedley & Voisinet of Buffalo for that territory.

New Improved Chains

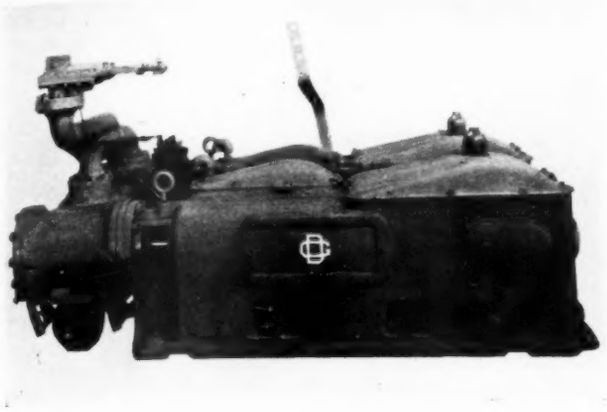
HOWE CHAIN COMPANY, Muskegon, Mich., announces the development of a new tubular cotter and a new improved line of chains, as follows:

XXS—1240	API—4	Strength, 150,000 lbs.
XXS— 40	API—3	Strength, 70,000 lbs.

These new chains follow much research work for new alloy steels and investigation of designs.

Gardner-Denver Announces Drilling Engine

GARDNER-DENVER CO., Quincy, Illinois, has announced a newly developed twin drilling engine that incorporates several novel features in design and construction. It will be known as the type DEB 12x12 Twin Roller Bearing Rotary Drilling Engine. It is designed to operate with 350 pounds steam pressure. The dimensions are:



Length, 9 feet ½ inch; width, 6 feet, 5 inches; height of engine proper, 3 feet 11⅝ inches; and over all height, 4 feet 7¼ inches. The weight installed is 14,000 pounds. A type of construction has been used that renders the engine as light and compact as possible for the high steam pressure of 350 pounds.

Steel Stairways by Black, Sivalls & Bryson, Inc.

WALKWAYS and stairways built entirely of steel, designed, perfected and manufactured for use on batteries of storage tanks, have been announced by Black, Sivalls & Bryson, Inc., Bartlesville, Okla.

Of excellent construction this equipment has been perfected so that it is simple to install and adaptable to any size and combination of tanks. There are only four different kinds of material used in the construction, i. e., safety walkway section, angle posts, bracing channels and stair treads.

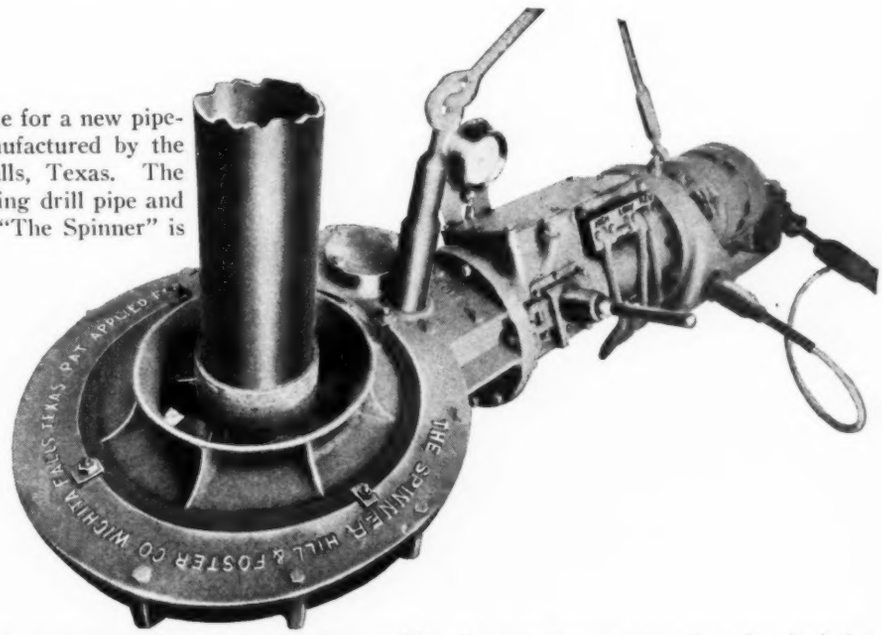
Safety walkways sections and stair treads are made by using one-half inch dies and three-eighths inch punch. This turns up a very high burr which makes these walkways absolutely safe under any kind of weather conditions, the manufacturers state.

All of the holes which may be used in the construction of the walkways are punched on two-inch centers for one-half inch bolts. By carefully spacing all of the holes exactly two inches center to center, it is practical to use these punchings for various fastenings as the occasion may demand. The walkways are therefore adaptable to any kind of a condition which may exist—and are strong and rigid. They are adjustable for use on tank batteries of any other height or length. The design of the equipment permits it to be taken down and used again and again without waste of material when the tank battery is moved to another location.

The initial cost of the installation is reasonably low, and the manufacturer states that, since the equipment will last indefinitely and the fire hazard has been eliminated, these steel walkways and stairways will be highly economical.

"The Spinner"

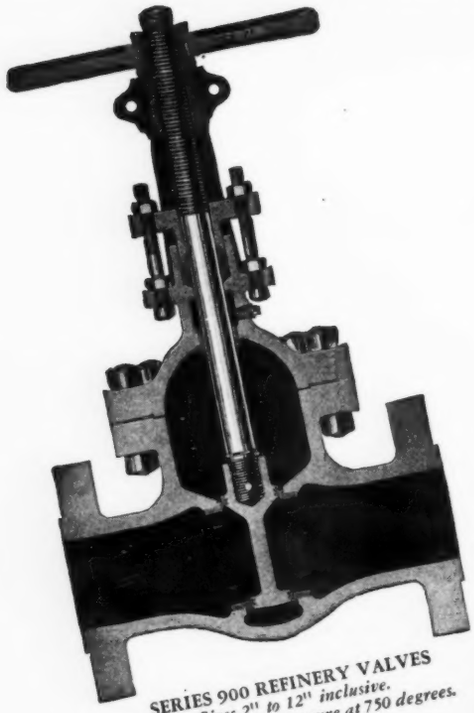
"THE Spinner" is to be the trade name for a new pipe-screwing device that is being manufactured by the Hill and Foster Company of Wichita Falls, Texas. The purpose of this machine is for use in screwing drill pipe and casing together as it is put into the hole. "The Spinner" is swung in the derrick like a tong on a counterbalanced line that will enable the operators to raise and lower it at will. When the first section of pipe or casing is set on the slips the Spinner is placed over the top of it, and as each additional section of pipe is set in the coupling or tool joint ready for making up, the machine is slightly raised; a forward clutch lever is pulled, the pipe is quickly tightened, a reverse lever is pulled, the gripping dogs disappear from view and the pipe can be let into the hole through the machine. "The Spinner" is composed of three major parts: motor, transmission and automatic gripping assembly.



The motor will be of a standard make. It will be electric, five-horsepower, three-phase, will run on 220 or 440-volt electricity and will have an automatic magnetic throw-out switch.

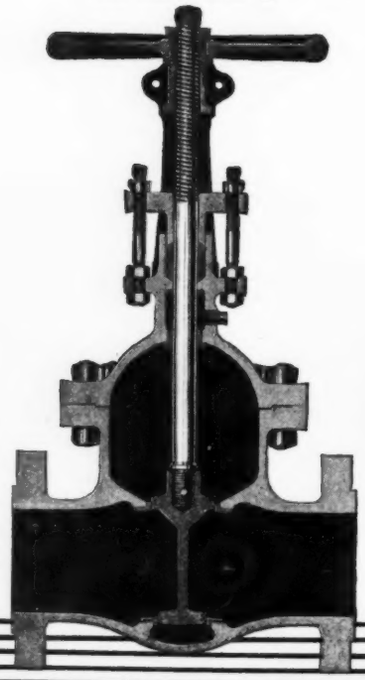
The transmission will be such as to enable the following speed rotations of the pipe: 57-31-20-18-11-6½ R. P. M. This variation will give just the speed or power suited to the operation at hand. The friction clutches used in this transmission enables the operator to turn the pipe inch by inch until he is sure the thread is straight.

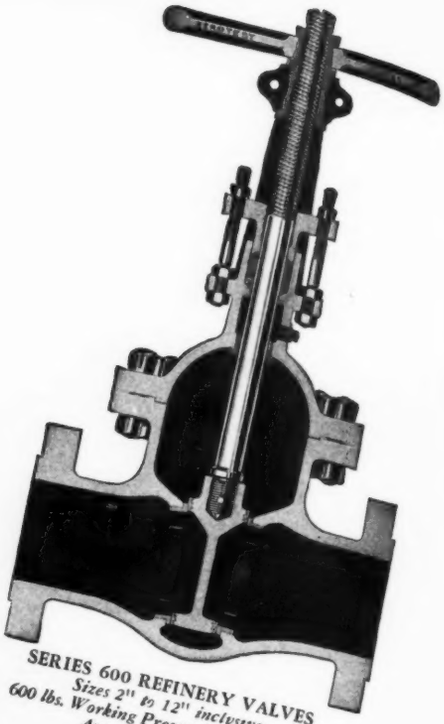
The automatic gripping assembly consists of a ring gear, an inner ring and five gripping dogs. The gripping dogs are loosely pinned to the inner ring and geared to the outer ring. When the outer ring is turned to the right, the inner ring lags behind and urges the gripping dogs into engagement with the pipe. When the ring gear is turned to the left the inner ring again lags and urges dogs back under cover and out of the way of the passing couplings as the pipe is lowered into the hole.



SERIES 900 REFINERY VALVES
Sizes 2" to 12" inclusive.
900 lbs. Working Pressure at 750 degrees.
Any class of trimming.

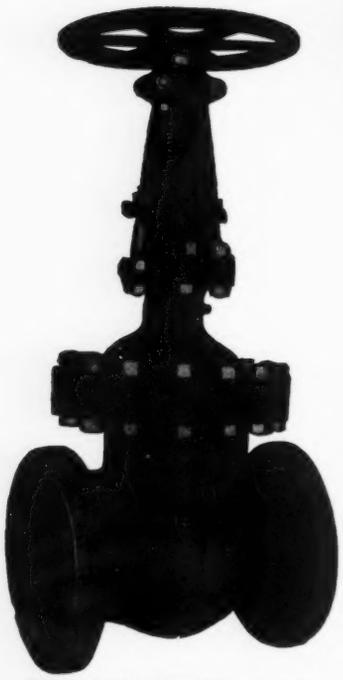
SERIES 400 REFINERY VALVES
Sizes 2" to 12" inclusive.
400 lbs. Working Pressure at 750 degrees.
Any class of trimming.





SERIES 600 REFINERY VALVES
Sizes 2" to 12" inclusive.
600 lbs. Working Pressure at 750 degrees.
Any class of trimming.

REFINERY VALVES



SERIES 300 REFINERY VALVES
Sizes 2" to 12" inclusive.
300 lbs. S. W. P. at 750 degrees.
Test Pressure 1000 lbs.

Whatever the service, pressure or temperature condition, you can depend on Kerotest to serve you and serve you well.

You will find in Kerotest, a complete line of refinery valves embodying the finest engineering practice—the perfected result of years of experience in meeting the most exacting requirements of oil and steam at high pressures and temperatures.

Kerotest Manufacturing Company
PITTSBURGH, PA.

Carried in Stock and Sold by NORVELL-WILDER SUPPLY CO.
Houston Beaumont Shreveport Fort Worth

OIL WELL SUPPLY COMPANY
Branch Stores in all Oil Fields

Export Distributors: OIL WELL SUPPLY COMPANY
Pittsburgh New York Tampico London

SERIES 150 REFINERY VALVES
Sizes 2" to 12" inclusive.
150 lbs. S. W. P. at 750 degrees.
Test Pressure 500 lbs.

New Tubing Retractor

A NEW tubing retractor for high-pressure flowing wells has recently been added to the list of control heads manufactured by J. H. McEvoy & Company of Houston, Texas. Even with tubing in the hole this retractor makes it possible to open and close the master valve at the Christmas tree at all times, the manufacturer states.

The inside of the heavy forged steel bushing between the master valve and the main string of casing is a beveled seat or shoulder which forms a seat or rest for the tubing hanger. The tubing hanger supports the tubing and is made with deep flutes, affording free circulation between the casing and tubing. The top of the tubing hanger is made into a bowl or seat for a movable plunger, which works on a rack and gear assembly and is controlled by a hand wheel and spiral gear. When the well is flowing the plunger is seated on the tubing hanger.

Baash-Ross Tool Company Pamphlet

THE Baash-Ross Tool Company of Los Angeles, Calif., is distributing a pamphlet entitled, "One Hundred Successful Oil Field Tools."

It states that this company has developed more than 100 tools and specialties to meet certain conditions in the oil fields. It discusses several of the company's recent perfections, such as: Roller bearing Kelly bushing; 18-inch extra long rotary slips; cam pumping unit; hi-deck crown block; auto-lock blowout preventer, and a few other articles.

Laclede-Christy Fire Brick Circular

THE Laclede-Christy Clay Products Co., of St. Louis, is circulating a letter type pamphlet on its laboratory tested fire brick. It states that the right fire brick is needed for the right place and that the selection of bricks is a scientific engineering proposition. Advantages of this laboratory-tested fire brick is described and the readers are asked, without obligation, to tell just how and where they are using fire bricks.

Maintenance Engineering Opens Ft. Worth Office

THE Maintenance Engineering Corporation of Houston, Tex., opened an office and branch warehouse at Fort Worth, Tex., on June 1st. It is in charge of M. A. Hart. This will make stocks more readily available for the North and West Texas territory.

Republic Opens Store at Hobbs

THE Republic Supply Company has opened a store at Hobbs, New Mexico, to supply this new oil area with Republic equipment. B. C. McMullen is district manager and H. A. Alexander, store manager.

Marion Anglesteel Derrick Catalog

THE Marion Machine, Foundry & Supply Co., Marion, Ind., has a catalog describing and illustrating its new Anglesteel drilling and pumping derricks.

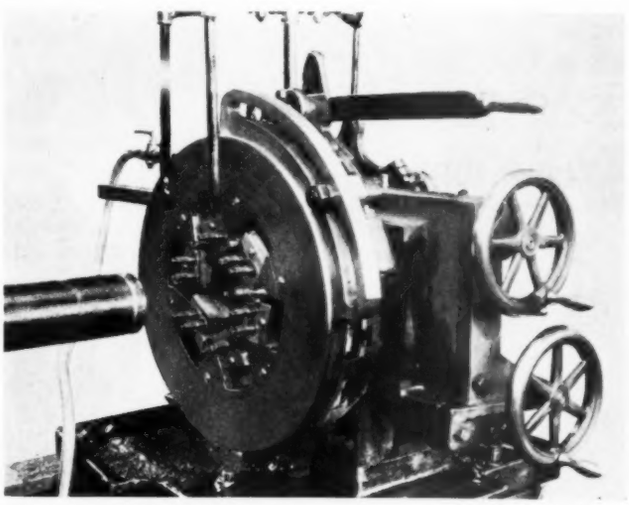
The general design of the Marion Anglesteel line derricks is the same as the Marion tubular steel derricks. The strength of all parts are computed in strict accordance with the specifications of the American Petroleum Institute.

The illustrations and editorial matter in the book is quite comprehensive. It discusses and pictures all of the important joints and foundation, as well as the gin pole and crown block construction. Specifications of the derricks will be found in the back of the book.

Landis Grooving Cutters for Victaulic Joints

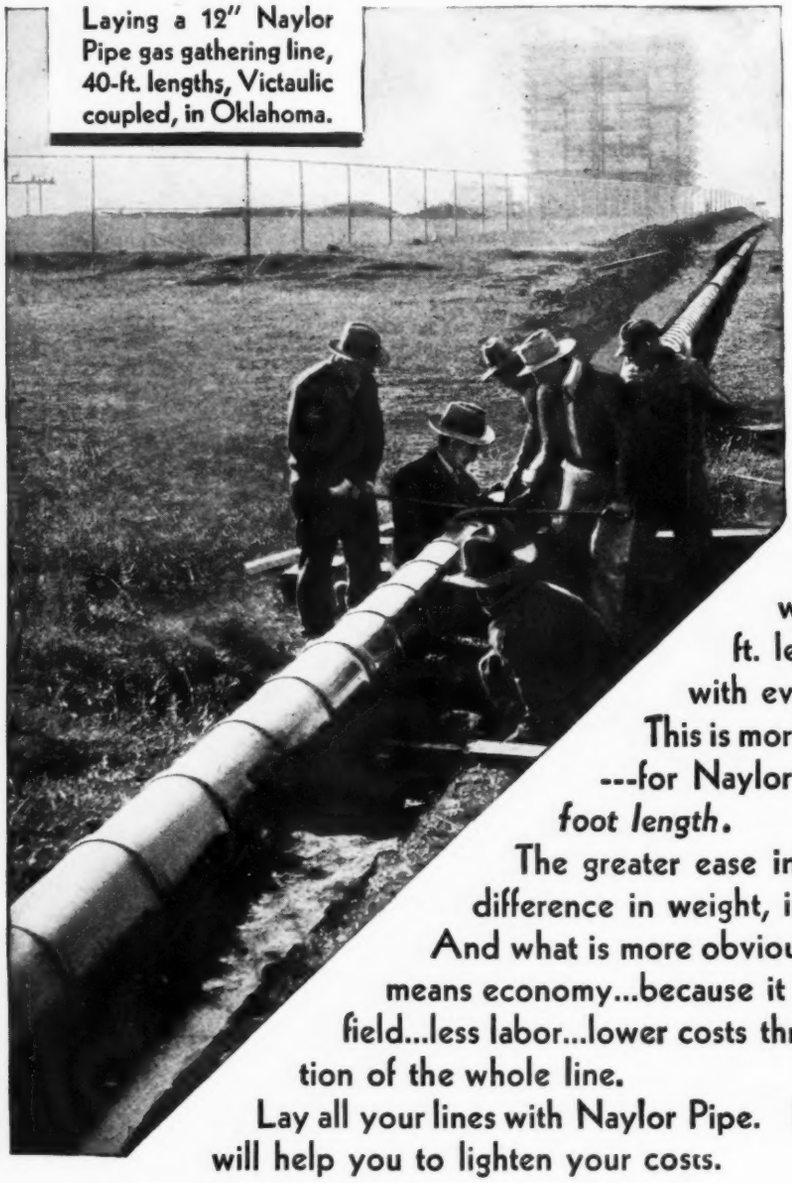
A CUTTER for grooving pipe and casing for Victaulic couplings has been developed by the Landis Machine Company, Waynesboro, Pa., for use on Landis pipe threading and cutting machines. These cutters are placed in the regular chaser holders of the stationary pipe die head which is used for threading standard pipe and casing.

The Landis grooving cutter is made on the same principle as the Landis chaser, but differs in that the thread form is omitted entirely and the face of the cutter is entirely flat except where the grooving offset is located. The grooving section of the cutter is the exact height and width corresponding to Victaulic standard grooves. The depth of the groover is controlled by the height of the offset on the cutter, but variations can be obtained by an adjustment of the die head in its closed position.



All cutters are interchangeable and made of high speed steel to reduce wearing. The length of the cutters are long to permit longer cutter life. When dull they are ground on the cutting edge only and moved forward in their holders to compensate for loss of metal due to grinding. The cutting edge is always on cutting center.

The number of cutters range from six in the smaller sizes to eight in the larger size heads. Two stop blocks, located diametrically opposite each other, locate the distance from the end of the pipe and can be easily reset.



Laying a 12" Naylor Pipe gas gathering line, 40-ft. lengths, Victaulic coupled, in Oklahoma.

On Your Next Pipe Line...

Why Handle 1878 Pound Lengths When 840 Pound Lengths Will Do?

When you lay a standard weight wrought pipe line (say a 16" line, 30 ft. lengths) it means handling 1878 pounds with every length.

This is more than twice the weight you need handle ---for Naylor Pipe weighs *only 840 pounds per 30 foot length.*

The greater ease in handling, due to this remarkable difference in weight, is obvious.

And what is more obvious is that pipe easily handled means economy...because it requires fewer men in the field...less labor...lower costs throughout the construction of the whole line.

Lay all your lines with Naylor Pipe. Its lighter weight will help you to lighten your costs.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

SALES OFFICES

3116 Chrysler Building, New York — Witherspoon Bldg., Philadelphia — 507 Philtower Bldg., Tulsa — 601 Post-Dispatch Bldg., Houston

MONTREAL, CANADA---Mechanical Equipment Co., 660 St. Catherine St., West

TONCAN COPPER

Naylor Pipe

Maximum Structural Strength — Mo-lyb-den-um IRON — With Minimum Weight

Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40' 0". Ends made to wrought pipe standards for all types of coupling.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

Toncan Copper Molybdenum Iron possesses a superior corrosion resistance, making it the favored pipe material.

When writing NAYLOR PIPE CO. *please mention The Petroleum Engineer*

Control Equipment Divided Into Classes

ENGINEERS of the Regan Forge & Engineering Company, San Pedro, Cal., have, for the purpose of simplifying the classifications of control equipment required in various fields to meet wide ranges of pressure, divided the equipment for control service into three classes.

The three classifications of Regan control equipment are now designated as Type "A" for normal pressures, Type "B" for medium pressures tested to 3,000 pounds, and Type "C" for high pressures tested to 6,000 pounds.

In the higher pressure classifications the flanges, spools, couplings and tubing heads are much heavier in weight. The Type "A" equipment is built to withstand pressures corresponding to the respective sizes of A. P. I. casing and tubing. The 3,000-pound test equipment is tested to 3,000 pounds, regardless of the size of any of the parts and is equipped with A. E. S. C. 900 series bolting and flanges. The Type "C" equipment is designed for high pressures regardless of size, each part being individually tested to 6,000 pounds. Facilities are provided by the manufacturer for testing this extra-heavy equipment in completely assembled form, including Christmas tree and valves. Bolting and flanges are built to A. E. S. C. 1350 series with other portions built in proportion.

A recent development in meeting the extra high pressures with Regan equipment is noted in the adoption of special hydraulic packing. No packing clamps are required with Regan flanges. Hydraulic packing is used, backed up by a slightly raised annular ring which gives a metal-to-metal contact after the packing is compressed, utilizing the load of the suspended casing plus the thrust applied by the flange bolts, which secures a tight seal between the flanges. The addition of this annular metal ring behind the packing adds an additional safety factor against fires, according to Regan engineers.

A new bulletin designated as No. 50 has just been issued by Regan describing the various classifications of casing control equipment.

New Type Separator Controls.

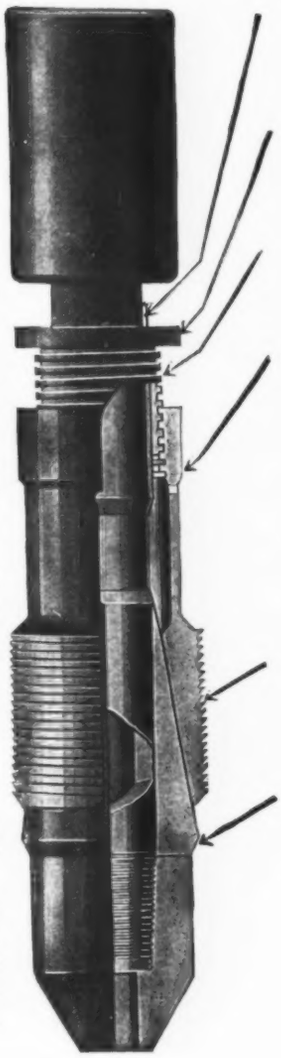
THE National Tank Company, Tulsa, Okla., announces, through its loose-leaf type catalog No. 7, Section 1, Insert 2, a new type of liquid level control for use on all sizes of National separators. It is know as the A. I. C. (Automatic Intermittent Control) type.

This type control has been designed by engineers of the company to meet severe conditions. It is controlled by the pressure carried on the separator or any other constant source of gas or air having sufficient pressure. A. I. C. controls may be easily installed on any National separator now in use in the field. With A. I. C. controls, the manufacturer states, wear from gravel and sand produced with oil in high pressured wells is reduced to a minimum as the valves are never in an intermediate position long enough to cause any considerable wear.

American Releasing and Circulating Spear

THE American Iron & Machine Works Co., of Oklahoma City, has announced the American releasing and circulating spear for drill pipe and casing. The spear is set with releasing nut well up in the top of the slip. This allows the gripping teeth section of the slip to rest on the mandrel. In this position an upward pull on the spear spreads gripping segments of the slip to a positive hold on the casing.

The arrows on the accompanying illustration indicate the following items: Top to bottom—Spear stem with keys, hollow for fluid circulation; shoulder on releasing nut; releasing nut, slides vertically on the stem and key; stop shoulder on stem, right-hand turn brings release nut down to this shoulder, raising slip away from mandrel, releasing spear; spear slip, solid ring at top end, lower portion slotted for expansion of the gripping section; mandrel, no lengthwise movement, but will rotate on the stem.



Chicago Bridge & Iron Works Opens New Office

THE Chicago Bridge & Iron Works has opened a new office in Houston, Texas, in the Electric Building. J. R. Donaldson, formerly in the company's Dallas office, is in charge.

Baash-Ross Now Distributors of Hazard Rope

THE Hazard Wire Rope Co., Wilkes-Barre, Pa., recently announced the appointment of the Baash-Ross Tool Company as the exclusive distributor in Southern California for all of their wire rope products. Stocks will be carried by Baash-Ross of the popular sizes and lengths of drilling, casing, improved casing and sand lines in their various field plants.

Hyatt Roller Bearing Co., Has New Western Manager

THE Hyatt Roller Bearing Company, Harrison, New Jersey, has appointed C. L. Newby, formerly assistant manager of its western division with headquarters at Chicago, as manager of that division.

Mr. Newby has been associated with the Hyatt Company since 1918 as sales engineer on general industrial, oil field, railroad and farm machinery applications.

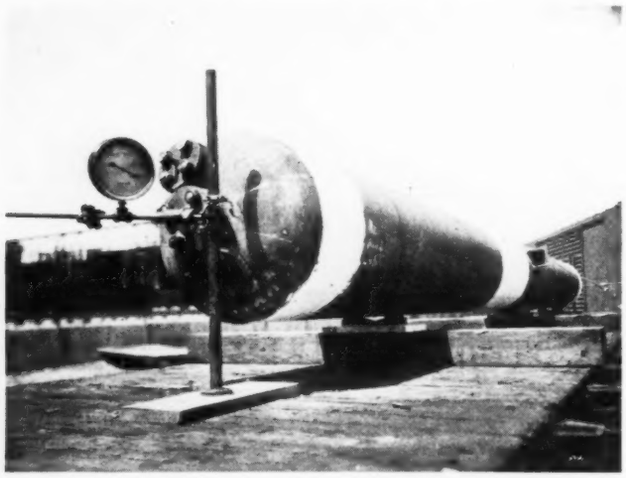
Pamphlet Describes Moon Lighting Outfits

THE Moon Manufacturing Company, Chicago, is distributing a pamphlet discussing the advantages of using Moon Lighting Outfits in the oil fields. The company's various types of generators and lighting plants are pictured, while the general features of Moon products are given.

Chrome Vanadium Vessel Tested to 10,000 Pounds

MOST severe tests for a welded vessel, reaching pressure of 10,000 pounds per square inch, were recently made at the plant of A. O. Smith Corporation, Milwaukee, Wisconsin.

The vessel tested was a reaction chamber built of chrome vanadium steel by Smithwelding for 5,000 pounds per square inch working pressure in a chemical process. The walls



were three and one-half inches thick and the vessel 33 feet long with 26 inches I. D.

Following routine repeated stress tests and hammer tests at 8,000 pounds the pressure in the vessel was raised to 10,000 pounds. A careful examination showed there was no scaling of the lime wash, and the vessel took no set or permanent distortion, according to the A. O. Smith Corporation.

Brown Instrument Instruction Catalog

THE Brown Instrument Company, Philadelphia, Pa., has just issued a revised edition of its electric flow meter instruction book. It is a 40-page, 8x10½ inches, fully illustrated book that explains the mechanism of the various types of Brown flow manometers, indicators and recording instruments. Instructions for installing the equipment, adjusting the instruments for zero readings, and changing range tubes are given.

Of special interest is the new low range manometer, model 252, which is furnished for measuring the flow of gas or air where the pressure does not exceed 50 pounds per square inch. This new manometer is described and pictured, together with the standard single and double range high pressure manometers.

Practical suggestions for avoiding difficulties are to be found in the book as well as tables of correction factors for pressure, quality and superheat of steam.

Vapor Recovery Bulletins

THE Vapor Recovery Systems Company, Compton, Cal., has three new bulletins for distribution. Bulletin No. 1 is a discussion of the history, pressures, vacuum, computing tank requirements and flow capacity of the "Varec" conservation vent valve or safety vent valve.

Bulletin No. 2 considers the "Varec" gauge and thief hole cover, used in protecting tanks where oil is stored.

The "Varec" super tank gauge is the subject of the third bulletin. This bulletin takes in to account the method of installing, working method and price list.

Aitken Joins Maintenance Engineering Corp.

M. N. AITKEN has joined the Maintenance Engineering Corporation, Houston, Tex., as sales engineer. He will assist in promotion of the more technical specialties for refineries, pipe lines and power plants, handled by Maintenance. Mr. Aitken is a graduate of the Rice Institute engineering department and for a period of time was connected with the engineering department of the Shell Petroleum Corporation.

"Fusion Facts" Now Published Quarterly.

"FUSION Facts," a publication of the Stoody Company, Whittier, Cal., manufacturers of welding rod, alloy steels and equipment, will be published every three months beginning July 1, 1930. The book will carry more complete data and descriptive information on the welding industry.

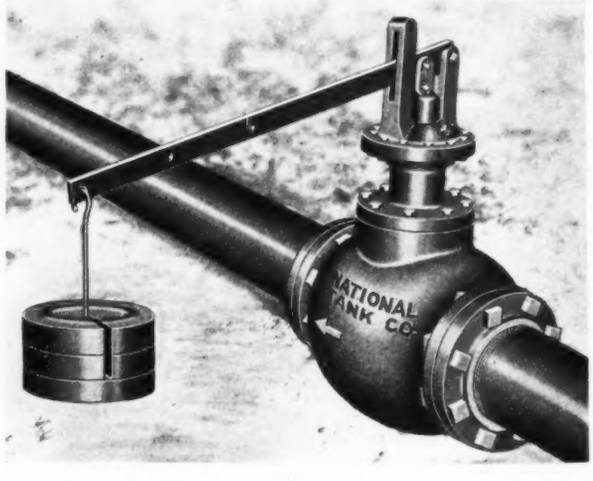
Foxboro No. 3 Type Planimeter Bulletin.

THE Foxboro Company, Foxboro, Mass., is distributing a bulletin covering its No. 3 Type Planimeter, which is designed for the integration of any Foxboro Types T and C flow meter charts. This company has also published full and complete instructions for operating this type planimeter.

Diaphragm Back Pressure Regulating Valves

THE National Tank Company, Tulsa, Okla., has developed a diaphragm back pressure regulating valve that offers very sensitive and positive control for back pressure use, officials of the company state.

It consists of a balanced valve directly connected to a diaphragm. Pressure is directly applied to the diaphragm through a passage around the stem. A ¼-inch pet cock connection in the diaphragm head regulates the breathing action of the diaphragm and a ¼-inch connection below the diaphragm permits the installing of a pressure gauge



for indicating the back pressure. The body of the valve is oversize to give extra capacity above the line pipe size, making overloading impossible.

The valve may be used as a vacuum regulator or breaker as well as a back pressure valve. A large arrow on the body of the valve indicates the direction of flow of the fluid. The valves are made in two sizes, 6-inch and 8-inch for pressure capacities of 5 to 30 pounds and 15 to 85 pounds.

New Ideco Straight-Line Heavy-Duty Crown Block

THE new Ideco straight-line, heavy-duty crown and Ideco 72-inch streamline traveling are a matched pair of blocks and make a combination unit unequaled in speed, power and economical operation, according to the makers, International Derrick & Equipment Company, Columbus, O.

This crown block has six 36-inch sheaves made of Idecalloy or manganese steel mounted in a line on a single 6-inch alloy steel, heat-treated center pin. Perfect vertical alignment of the wire lines between the crown and traveling block and of the sheave assembly with the center of the well is provided.

The sheaves of this Ideco crown block and their bearings are interchangeable with those on the Ideco 72-inch heavy-duty traveling block. The grooves are ground smooth and take a high polish; the contour conforms to A. P. I. specifications for 1-inch and 1⅛-inch wire line.

American heavy-duty roller bearings, having one-inch diameter rollers and hardened inner and outer races, are used. The inner race is pinned to the center pin to prevent revolving and takes the wear off the rollers instead of their bearing directly against the surface of the center pin. The latter is held in place by the center pin bearings.

Detailed description of this new crown block may be obtained from the manufacturer by writing.

General Electric Bulletin Series

A NUMBER of bulletins have been issued by the General Electric Company of Schenectady, N. Y. Catalog GEA-606B represents a reprint of the Industrial Control Setcion of the General Catalog 600A, pages 825 to 985. It furnishes information on representative lines of industrial control manufactured by the General Electric Company. It also includes instructive matter on the care and operation of control devices, wiring diagrams of standard controllers, push buttons and other accessories.

In addition to this catalog the company has published a comprehensive booklet on non-metallic gears and blanks, which is catalog GEA-818A. Another booklet is on Fabroil gears. Three of the General Electric loose-leaf type bulletin published recently are as follows: GEA-246B on General Purpose Synchronous Motors; GEA-973A, on CR3100 Drum Controllers, and bulletin GEA-1252, dealing with the CR9440-LS415 type Hatchway Limit Switch for control circuits.

New Excess Pressure Pump Governor

BULLETIN No. 270 of Neilan Company, Ltd., Los Angeles, fully describes the new Neilan excess pressure pump governor. Several improved features are shown, such as the improved "Seatringuide" Valve and the widespread use of non-corrosive metals. The valve plug guides on the governor are made integral with the seat rings. Experimental research, according to the company, has shown that this valve design gives small frictional resistance and flow turbulence, thus giving the valve a larger capacity.

Duriron in the Refinery

THE Duriron Company, Inc., Dayton, Ohio, of which Edward Soph, Tulsa, is Mid-Continent distributor, has published a booklet entitled "Duriron in the Refinery."

This bulletin describes the Duriron equipment applicable to the oil refinery industry. It also describes the features of Duriron, an iron silicide, commonly known as high silicon iron. The bulletin is well prepared and illustrated.

This company is also distributing a reprint from the "Duriron News" of November, 1929, in which Mr. Soph discusses Duriron mixing nozzles and their use in the refineries of Oklahoma.

Company Changes Name

NEILAN, SCHUMACHER & COMPANY, Los Angeles, Cal., manufacturers of automatic control and regulating equipment, will, in the future, be known as Neilan Co., Ltd. A. F. Schumacher, formerly vice-president, has retired from the business.

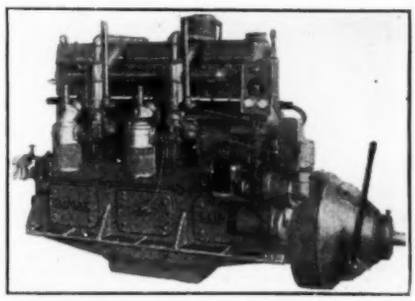
As before, the trade name of Neilan will continue to be used on all control equipment made by this company. The new cable address will be Neilanco, Los Angeles.

Murray Tool Appointed Distributors

MURRAY TOOL & SUPPLY COMPANY of Cleveland, Okla., has been appointed exclusive distributors for Doheny Stone "Hydril" equipment in Oklahoma, Kansas and Texas.

This company has also been made distributors of products of the Hughes Tool Company.

Gas-Oil Fuel Engine Announced by Climax



THE Climax Engineering Company of Chicago, Ill., and Clinton, Iowa, has announced that its Blue Streak engines are now provided with equipment making possible the use of crude of 36 to 40 degrees gravity as fuel. Equipment is the same as that employed on the gasoline-burning engine, with the addition of an oil rectifier, a heat control mechanism and a water supply for full load operation.

The oil rectifier reduces dilution of the lubricating oil, maintaining it at a satisfactory minimum for successful operation. It is said that the dilution will not exceed standard gasoline operation.

The heat supplied to the fuel mixture is varied automatically with the load to provide the flexibility necessary for the successful handling of the different loads and speeds encountered in the various industrial applications.

On demands for power exceeding three-quarter load, the movement of the syphon, which is attached to the intake manifold, opens a valve controlling the supply of water to the fuel mixture. The water supply is furnished by a conventional diaphragm fuel pump mounted upon and driven by the engine.

Gasoline is used in starting until the engine is warmed up, when the gasoline supply is cut off and the fuel oil admitted. No other operation is required.

The Elliott DRILLING BIT

A new bit embodying new speed and efficiency in making hole—longer runs—new economies in service.

. . . during all the years we have devoted to the pioneering and development of the Elliott Rotary Core Drill, we were, of necessity, intensively perfecting the *fast and efficient digging feature of this tool.* It is but natural that this extensive and specialized effort should produce *hole-making features* of more than ordinary merit.

. . . and so, we have embodied these exceptional hole-making features in a bit to be used exclusively for drilling purposes.

. . . and here it is. We will leave the verdict to you. Judge it in any kind of drilling service, under any service conditions, according to any standards you choose.

. . . complete data will be supplied to any interested companies or individuals on request.

Elliott
CORE DRILLING COMPANY
4751 East 52nd Drive
LOS ANGELES CALIFORNIA.

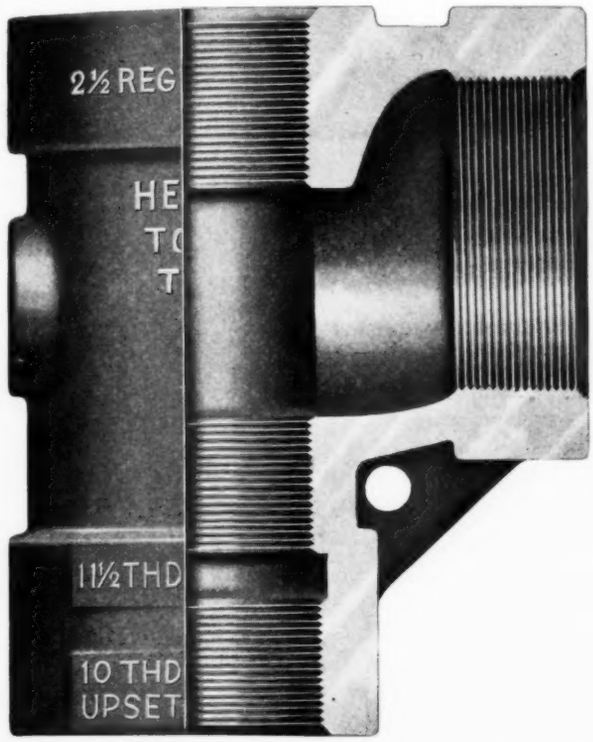
Mailing Address: P. O. Box 55, Maywood, Calif.
Export Office:
150 Broadway, New York

BACKED BY THE *integrity* OF A GOOD NAME

When writing ELLIOTT CORE DRILLING CO. *please mention The Petroleum Engineer*

New Hercules Upset Pumping and Flowing Tee

A NEW Hercules Upset Pumping and Flowing Tee has been announced by the Hercules Tool Co. of Tulsa, Okla. It is a combination pumping and flowing tee, made with both regular and upset threads on the bottom. No cutting off of the upset end of tubing at the top of the



well is necessary, and swage nipples are not necessary to reduce from the upset to regular threads.

Each tee has a regular thread on top, a 90-degree side outlet for lead or flow line. On the back side there is a one-inch opening for a bleeder valve, or for connecting a pressure gauge if used on air lift. It is tested for 3,000 pounds. A detailed descriptive pamphlet may be secured from the company.

New Marley Spray Cooling Tower

THE Marley Company, Kansas City, Mo., has recently developed and offered to the trade a new spray cooling tower of much smaller size than any heretofore made by this company.

The new tower is called type "G" and is intended to fill the need for a compact, efficient and durable cooling unit of but a few gallons capacity. It is ideal for capacities not exceeding ten to twelve gallons capacity, the manufacturer states.

Cast iron is used wherever possible; the water box, main tower frame-work and bracing being of this material. The entire main frame-work can be assembled in but a few minutes' time. The louvres are slip fit requiring no nails or screws and are of California redwood. The automatic floating control valve is standard equipment on the unit.

Hinderliter Adds New Field Facilities

HINDERLITER TOOL CO., Tulsa, Okla., has opened a new branch store at New Hobbs, New Mexico, to service that new field. E. R. Dickerson is store manager.

The company has also opened a new forge and machine shop in connection with its branch store at Odessa, Tex.

Trackson Crawler Wheels

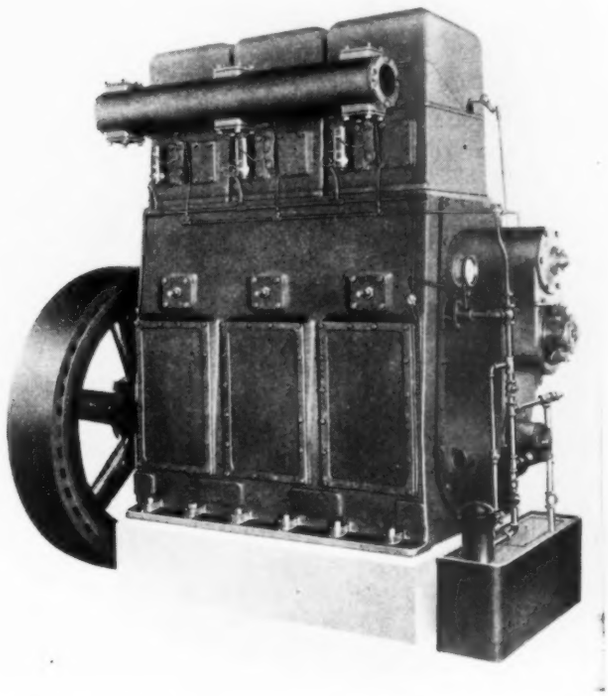
TRACKSON COMPANY, Milwaukee, Wis., announces the placing of Trackson crawler wheels on the market for wagons. These Trackson wheels are built for hauling over muddy, sandy, rough and rocky ground, where regular type wheels might mire down. The wheels are of large diameters and wider tracks to permit easier pulling.

The tension members, which hold the shoes in rigid rail position are practically wearproof, because they are made of extra heavy drop forgings, specially heat-treated and hardened and move to and fro without turning or grinding action.

Cooper-Bessemer Vertical Engine Catalog

THE Cooper-Bessemer Corporation, Mt. Vernon, Ohio, has published a catalog on its vertical engine. Several of the vertical gas engines are improved models of those previously offered.

A newly-developed convertible engine is offered for use



with gas as its fuel, but which can quickly be changed over to an oil-burning engine. It is completely enclosed to keep all dust and dirt out of the moving parts.

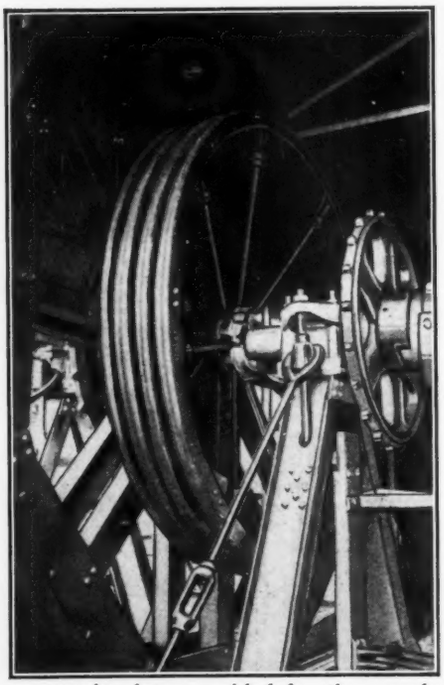
The engine is 11½-inch bore and 14-inch stroke. It is rated at 135 horsepower. Its main applications are for auxiliary power as well as industrial use.

Stratco Bulletins

THE Stratford Engineering Company, Kansas City, Mo., has published Bulletin 100 and Bulletin 101. Bulletin 100 is concerned with liquid level controls and diaphragm valves for the petroleum industry. Besides illustration and a mechanical description, several illustrations of installations are given.

The other bulletin is about the Stratco continuous treating plants and dispersion contactors. The object of this pamphlet is to present to oil refiners a new type of continuous treating system, intended for the chemical treatment of all types of petroleum distillates.

Parkersburg Announces New Equipment



THE Parkersburg Rig & Reel Company of Parkersburg, W. Va., announces the development and manufacture of a new Tug Rim Brace, New Type Steel Band Wheel, and A. P. I. Derricks.

The tug rim brace was developed to reinforce the band wheel tug rim for heavy duty rigs. It consists of a split collar hub which clamps around the shaft next to the band wheel hub. The adjustable spokes are set in slots provided for them and radiate like the ribs of an umbrella to the outer groove of the tug rim. These spokes can readily be tightened to the proper tension.

The new steel band wheel is adapted for use with either chain-driven or friction type sand reels. The ship channel arms fit closely over the cast bosses on flanged hub, taking the shearing stresses off of the bolts, preventing play in the arms. This construction eliminates loose bolts and rivets and assures true running and reduces vibration. The band wheel is designated as type "M" and is made in 10, 11, 12 and 14-foot diameters with 12, 14 or 16-inch faces; furnished with either double or triple tug pulleys as optional equipment.

The Parkersburg derricks can now be obtained to conform to standards of the A. P. I. The derricks are of steel angle construction, with a patented slot-bolt feature at the joints. This principle is used in making A. P. I. 122-foot derricks in both rotary and combination drilling types. Also, 87-foot and 94-foot cable tool derricks are being built to A. P. I. standards.

"The Centrifugal Pump" Handbook

EVERY phase of the centrifugal pump, from theory to installation and operation, is covered in the comprehensive and complete data published in the handbook "The Centrifugal Pump," compiled by F. G. Switzer, Professor of Hydraulic Engineering, Cornell University, for Goulds Pump, Inc., Seneca Falls, N. Y.

The handbook is a practical one with data valuable to the technical student, instructor, trained engineer and pump operator. An interesting chapter in the book is that on testing, in which the reader is taken through a modern testing laboratory and shown, step by step, how centrifugal pumps are inspected and put in perfect operating condition before they leave the factory.

Equipment Firm Organized

A modern manufacturing plant is being erected in Fort Worth by the Oil Field Engineering Corporation, which was organized by H. L. Kime, Tulsa, Oklahoma; H. D. Parker, Coffeyville, Kansas, and Jon R. Long, Fort Worth. This concern will enter the manufacture of oil and gas production equipment within sixty days.

Several of the patented products the Oil Field Engineering Company has been licensed to manufacture are the Leidecker ball and seat check valve, the Hoff-Jones stuffing box, and the Long high-pressure casinghead and bradenhead. The company will also make a line of specialties for application in the oil and gas fields and will handle contract work on special equipment.

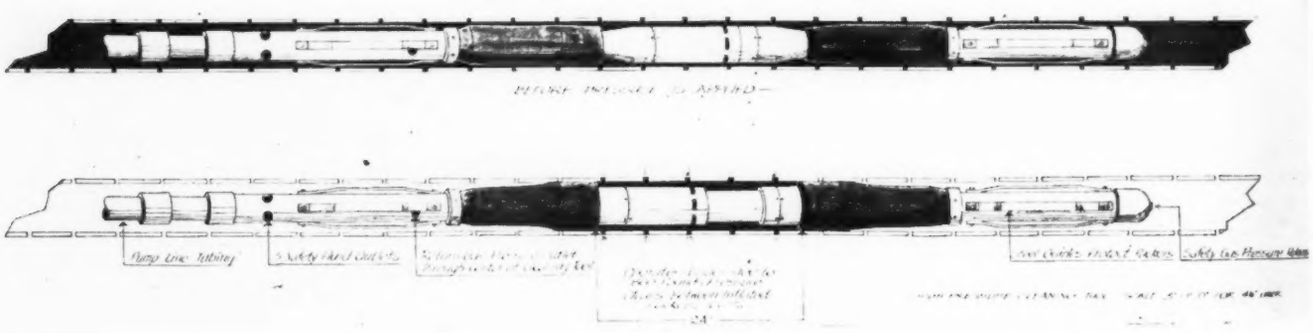
The executive officers will be located in Fort Worth, with Jon R. Long as general manager, and Charles A. Little as sales manager. Warehouse stocks will be maintained at Houston and San Antonio, Texas, and Eldorado, Arkansas, by Jon R. Long; in Tulsa, Oklahoma, and Coffeyville, Kansas, products will be stocked by Robinson Packer Company.

New Booklet on Bettis Protectors

SIXTY-TWO interesting reasons why Bettis Protectors should be used on oil well casings are presented in a new piece of literature just published by the Patterson-Ballagh Corporation of Los Angeles.

The new literature is being distributed through the corporation's New York and Los Angeles offices and through its distributors in Oklahoma, Texas and Gulf Coast fields.

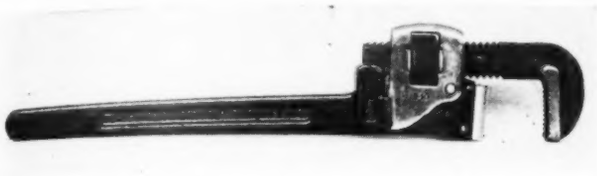
New Standard Oil Well Cleaner



THE Standard Oil Well Cleaning Company, Kennedy Building, Tulsa, has introduced a new Standard oil well cleaner. It applies from 400 to 1000 pounds pressure to every 24 inches of the perforated liner, using a dissolvent which will cleanse the screen inside and out and disintegrate the B. S. paraffin or asphaltum which has solidified, and loosens and removes other foreign matter. It opens up clogged or partially filled areas in a perforated liner and circulates the fluid under high pressure against the formation outside the perforations.

New Improved Trimo Wrench

A NEW improved Trimo pipe wrench is being made by the Trimont Manufacturing Company at Roxbury, Mass. The new wrench has a drop forged (not malleable) handle. At the side of the frame lugs have been built on



the handle to hold the frame in position and keep it in the proper alignment. The frame of this tool has been greatly enlarged. The movable joints are put through a special toughening process. Every feature of safety and strength has been incorporated in the new Trimo.

Design for Oxwelded Piping

IN THE May Issue of "Oxy-Acetylene Tips" an article on the design for oxwelded piping was carried. The article took up the various types of welds, with illustrations showing each. The data contained in the article was obtained from the engineers of The Linde Air Products Company, which has developed standard designs for the various type of joints recommended for oxwelded piping systems.

Control Head for Running of Tubing Under Pressure

BY USING two C-I-W control heads, it is possible to snub tubing into wells against highest pressures without shutting off the flow, according to the Cameron Iron Works, Houston, Tex.

The main body of the C-I-W control head is cast in one piece of steel with flow-line openings on either side. It is equipped with the same type steel rams as used in the

blow-out preventers, the rams being machined on top and bottom in order to suspend tubing thereon with the aid of the couplings.

The use of two ratchet lever jacks that force the rams with their hydraulic rubber packing very securely around the tubing permits the obtaining of speed with which tubing may be completely packed or unpacked. They are also equipped with lock screws that enable any degree of pressure to be applied on the tubing.

C-I-W control heads are made in two sizes. The regular type is tested to 1200 pounds pressure and recommended for use on wells developing less than 500 pounds pressure. The heavy duty type is tested to 6000 pounds pressure and designed for use on wells developing over 500 pounds pressure.

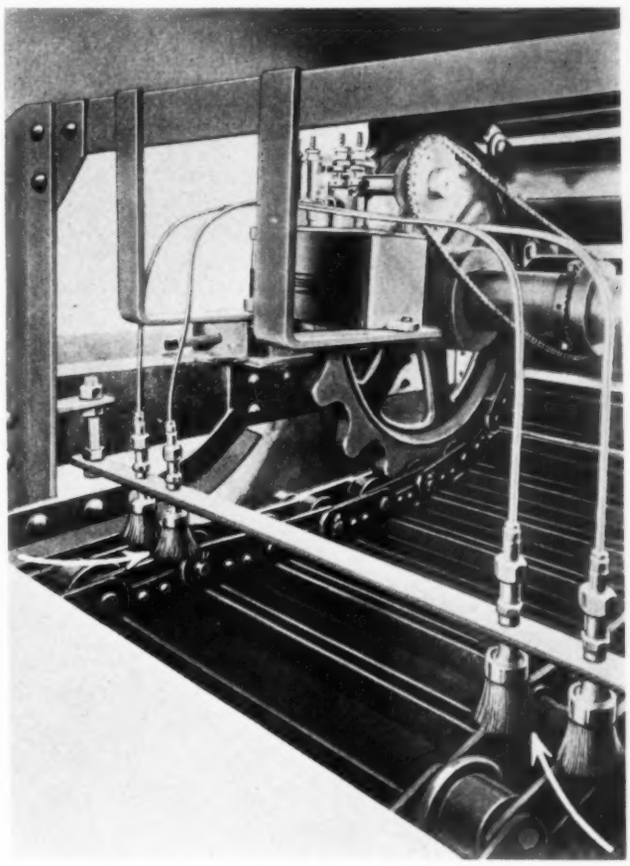
Bridgeport Has New Store

The Bridgeport Machine Company, of Wichita, Kan., has opened a new branch store at Odessa, Texas. R. M. Griffin is the manager.

Hills-McCanna Force Feed Lubricator

POSITIVE lubrication of a heavy duty apron conveyor, used for carrying filled and empty drums, was made possible by one large company by installation of a Hills-McCanna force feed lubricator.

The lubricator is mounted on the under, or slack side, of the conveyor. Oil is forced by the pump to the brushes through one-quarter inch O. D. copper tubing. As each link in the chain passes beneath the brushes it is coated



with a film of oil. The Hills-McCanna lubricator used on this installation is a four-feed unit driven by a sprocket and chain from one of the main drive shafts.

These lubrication feed units are built in several sizes, ranging from pint capacity, single feed units to large units having as many as 60 feeds.

Red Star Duplex Welding and Cutting Regulator

THE Bastian-Blessing Co., Chicago, has announced the new Rego Red Star Duplex two-stage regulator for welding and cutting.

Both stages are governed by regulators having large size diaphragms of proper material, functioning at any desired pressure, the manufacturer states. The proper proportioning and balancing of the action of these two regulators results in the maintenance of a constant neutral flame, regardless of fluctuations in tank pressure. A simplex lock-nut has been placed on the second stage adjusting screw to prevent vibrations of adjacent machinery to the welding or cutting apparatus from jarring the adjustment screw out of its proper position. Special shaped hexagonal adjusting screws are used to permit close adjustments.

The Red Star Regulator is designed so that it not only can be used for welding and cutting, but both operations can be done simultaneously.

H. S. Austin.

H. S. Austin, formerly president of the Tuscarora Oil Co., owners of the Tuscarora pipe line system, is now president of the Ajax Pipe Line Co. and is temporarily located at Tulsa, Okla. Mr. Austin, who has been identified with the pipe line branch of the petroleum industry for many years, is no stranger to the Mid-Continent, as he spent seven years with the Oklahoma Pipe Line Co., serving as engineer, assistant general superintendent and chief engineer.

With Mr. Austin in the Ajax is John R. Doles, who will serve as vice-president and general superintendent. Mr. Doles has been division superintendent of the Oklahoma Pipe Line Co. at Ardmore, Okla., for several years, and wears a twenty-year service button of the Standard Oil Co. of New Jersey.

ð ð ð

K. B. Nowels, Bureau of Mines, Laramie, Wyoming, has resigned, effective July 1st. At that time he will become chief petroleum engineer for the Forest Oil Company at Bradford, Pa.

ð ð ð

W. J. Cheley, president of the Zero Hour Torpedo Co., of Tulsa, has returned from a ten-day trip to Denver, Casper and other points in the Rocky Mountain region.

ð ð ð

W. T. Waggoner, Jr., has assumed the position of manager of the Waggoner refinery, Electra, Texas, succeeding Charles F. Kolp, who resigned. H. D. Jenkins will be assistant to Waggoner.

ð ð ð

Jim Morgan, so well known in petroleum equipment circles, informs us that he has caught up on his golf, and has joined Steve Dillon in The Dillon Company of Tulsa, Okla. Henceforth Jim will devote his time to selling the new Dillon couplings.

ð ð ð

Frank L. Chase, vice-president and manager of operations of the Lone Star Gas Company, recently fell and broke his right leg while in Council Bluffs, Iowa. Last reports are that the leg is mending nicely.

ð ð ð

H. J. Woolslayer has recently been appointed field engineer for Lee C. Moore & Company, Inc., in the Mid-Continent fields. Mr. Woolslayer has made two trips through Colombia and Venezuela for the Lee C. Moore Company and was employed as engineer for the Lago Petroleum Corporation in South America for about a year and a half.

H. J. Woolslayer.

ð ð ð

E. S. Browning has resigned as vice-president of the Hill-Hubbell division of the General Paint Corporation.

ð ð ð

Walter Swaney of the Kerotest Manufacturing Co. is back in Pittsburgh, Pa., after a ten-day trip to the Mid-Continent field.

ð ð ð

James A. Fenwick, president of the Fenwick-Reddaway Mfg. Co. of Newark, N. J., is making a trip through the Mid-Continent oil region.

ð ð ð

Jake Juker, representative of the Noble-Olson Drilling Company, has been transferred to Casper, Wyoming, where his company is drilling a rotary test.

ð ð ð

A. B. Cook, district superintendent production department, Southern division of Continental Oil Co., is recovering from an attack by hijackers. He was robbed and beaten on his way from the Oklahoma City field to his home in Shawnee.

ð ð ð

James H. Caldwell has been elected chairman of the board of Ludlow Valve Manufacturing Company, Troy, N. Y. William H. Lolley has been elected president, succeeding Mr. Caldwell.

John R. Doles.

Jim Morgan

A. B. Cook

BJ *takes the danger out of deep drilling*

BJ TRIPLE-EXTRA-HEAVY
CENTER LATCH ELEVATOR
(Wilson)

PRESENTS the convenience and easy handling of companion types...known and used the world over... plus twice the strength needed to carry safely the longest string ever run.

In every "string" there is a weakest link...BJ Weldless Links are the strongest

7 Types of BJ Center Latch Elevators now available:

Light Weight
Medium Weight
Extra-Heavy
Double-Extra-Heavy
Triple-Extra-Heavy
Extra-Heavy Tubing
Double-Extra-Heavy Tubing

(Write us for lists of sizes and complete information)

BYRON JACKSON CO.
Established 1872

General Offices: 2150 East Slauson Avenue, Los Angeles, California.

Tulsa Oklahoma City Houston
Shreveport New York City

When writing BYRON JACKSON CO. *please mention The Petroleum Engineer*

Caustic Treatment *of* Distillates

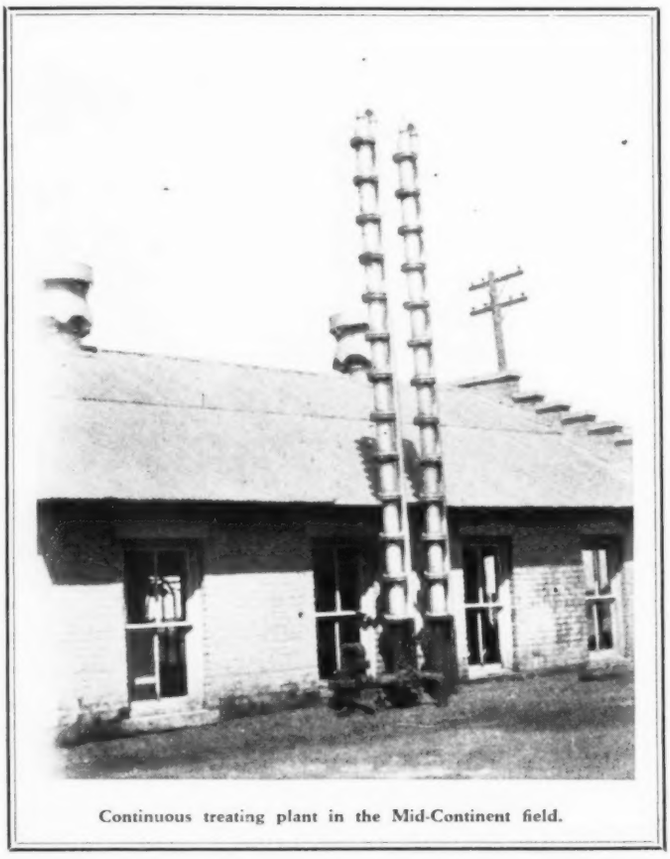
By L. C. ATCHISON

Chief Chemist Crystal Refining Company, Shreveport, La.

THE use of sodium hydroxide in treating may seem a closed book to most of us, and in the usual sense it may be. A great deal, however, depends on how and when it is used. We do not intend to discuss the entire subject, but only one phase of it. Those familiar with treating know the difficulty of meeting a .10 per cent sulfur requirement; more so with high sulfur crudes. They also know the bad effects of free sulfur and the impossibility of removing it. Any step that helps, even if only a little, will finally get the results, if enough steps are taken.

The distillate that we were treating contained from .28 to .30 per cent sulfur and could be treated down to .15 per cent, but with an objectionable amount of free sulfur. In experimenting with a sodium hydroxide wash several unusual results were obtained. A preliminary analysis gave .04 per cent hydrogen sulfide, a trace of free sulfur and .10 per cent mercaptans.

In the laboratory widely varying results were obtained, but after checking all tests we found that the sulfur-removing properties of sodium hydroxide depended upon the length of time the distillate had been exposed to the air. This was to be expected. However, the time element is surprisingly short. If the distillate was agitated with 20Be caustic before contact with the air, an average of .08 per cent of sulfur was removed; but if thirty minutes or more of air contact was allowed less than .02 per cent was removed. Five minutes air contacting lowered the effectiveness of the caustic 50 per cent; ten minutes, 75 per cent. After thirty minutes no further changes could be noticed, though some samples were retained and tested at intervals for several months.



Continuous treating plant in the Mid-Continent field.

A study of the various reactions proved that five minutes hand-shaking of a sample with sodium hydroxide was sufficient to remove all hydrogen sulfide. This amounted to a total sulfur reduction of .04 per cent on one item alone and stopped the production of free sulfur in the distillate. This same treatment removed .04 per cent of mercaptans. It is reasonable to suppose that the mercaptans are contained in the lower boiling point constituents of the distillate and could therefore be removed later, but the experiments proved that the sooner the better. Apparently a trace of free sulfur is removed, though not enough to detect, by the usual lamp sulfur. Some complex sodium salts are formed and these have a slight affinity for free sulfur.

Sodium hydroxide also stabilizes cracked distillates when used in this manner. An ideal condition exists when caustic is used as described above and the material stored for a month or more. This was shown by the results of a number of gum tests. The distillate before treatment had a gum of 100 to 150 mgs., of which 20 to 30 mgs. was soluble in acetone. After caustic treatment the gum content was 40 to 50 mgs., of which 15 to 20 mgs. was acetone soluble.

After sixty days storage the gum had dropped to 25-30 mgs., with about the same amount acetone soluble. Later in plant practice we considered the reduction in gum content as one of the most valuable features of the treatment, and to some extent used it as a means of control.

One other advantage of this method is the fact that less acid may be used for an equal sulfur removal. Starting with .18 per cent sulfur, ten pounds per barrel of sixty-six acid would remove .06 per cent of sulfur. This does not consider any other aim in treating, such as color, corrosion, etc., but merely sulfur removal. If the material is washed as above described, ten pounds of acid would remove on an average of .09 per cent of sulfur. Thus for the same sulfur decrease less acid will suffice.

The running of a plant treater for this work can be left up to the stillman. Laboratory control need concern itself with only two things: Removal of hydrogen sulfide and gum content. It may be said here that both glass and copper dish tests were run throughout the experiments, with only minor differences in results.

The particular application set up required no great complication. The distillate leaving the receiving house was under a pressure of 30 to 35 pounds, so it was only necessary to provide for the pumping of the treating agent. The chemical was introduced into the distillate through a tee on the run-down line. After passing through several mixers the material was put into a settler or drum. The caustic was drawn off at the bottom and went to the pump for the return trip. A small chemical tank was placed in series so that more material could be added to the system and to enable the stillman to keep the proper levels.

How Else

Are You Going to Explain It?

TRIMO is and always has been the leading pipe wrench in the oil industry. That statement will be borne out by a casual questioning of the the men on the rig or a searching analysis of requisitions the country over.

It isn't as if TRIMO's leadership had never been contested. Plenty of others have tried to win the oil man's choice. And it isn't that oil field work doesn't test the true worth of a pipe wrench. It's the hardest test for a wrench in the world.

There is only one reasonable explanation. All Steel TRIMO holds its place at the top because of its strength, its safety, its superior dollar for dollar value. How else are you going to explain it?

TRIMO
Pipe Wrench

TRIMO

All Steel for Strength and Safety

Handle Drop Forged -- Not Cast

Made by Trimont Mfg. Co., Inc., Roxbury (Boston), Mass.

When writing TRIMONT MFG. CO. *please mention The Petroleum Engineer*

KEWANEE

125 H. P. Kewanee Rotary Drilling Boilers operated by the Wofford Drilling Company on Milner No. 1 of T. B. Slick Company, Oklahoma City.

INTERNATIONAL

TULSA, *Supply Company* OKLA.

When writing INTERNATIONAL SUPPLY CO. *please mention The Petroleum Engineer*

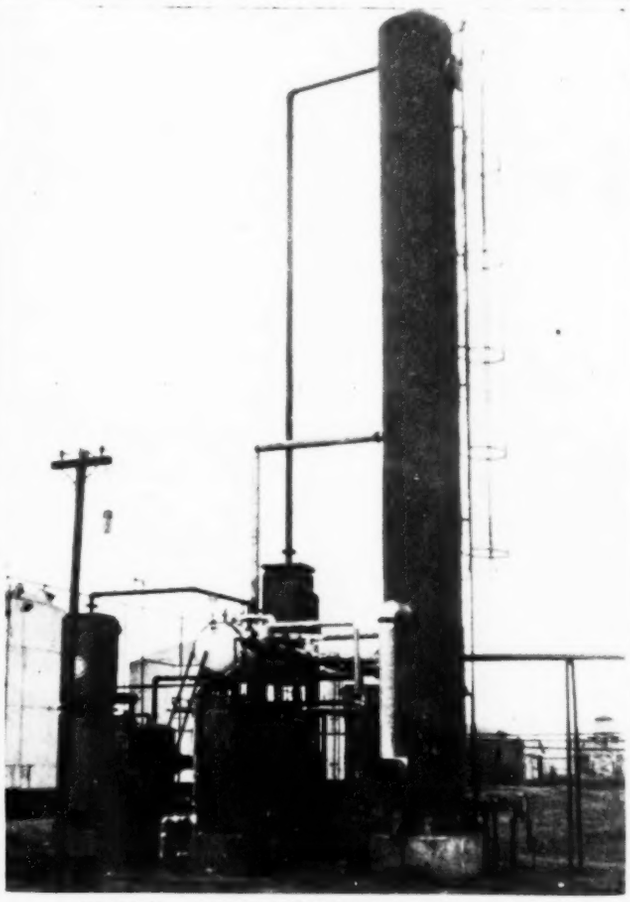
Twenty Years' Progress in

Natural Gasoline Manufacturing

By FRANK P. PETERSON, *Mid-Continent Petroleum Corporation*

NINETEEN-TWENTY-NINE and nineteen-thirty can definitely be stated to conclude a 20-year period of growth and development of the last "natural born" child of the great petroleum industry. As the current years accumulate of plenteous oil supply for every conceivable use in our United States, the once-spellbinding topic presents little, other than in review, to be said on the subject.

The new material came into recognition as such generally in 1910. It was appropriately named "Casinghead," because it was actually observed under favorable temperature conditions to literally drip from that well-known oil field fitting, and since the term is altogether distinctive, to this day in contradistinction to the more modern "controlhead," I have always had a slight sentimental regret that the contingencies of trade and competition seemed to suggest the change which imposed the newfangled term, natural gasoline. However, be all this, for the sake of sentiment, as it may, we now have with us the lusty youth approaching closely the age when he may step up to the poll and vote his sentiments.



Distillation unit in an Oklahoma City gasoline plant.

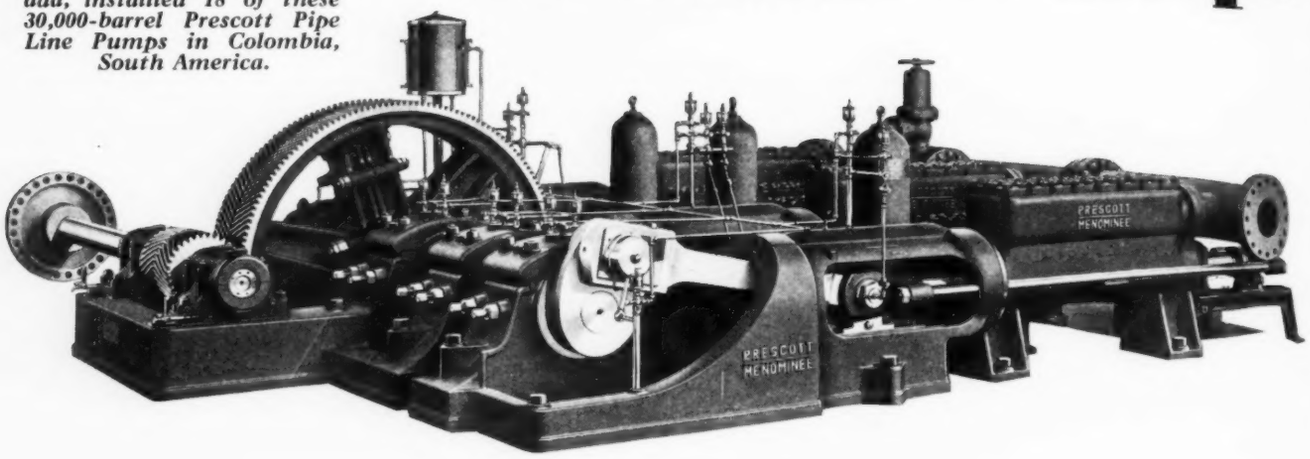
Away back—in 1912, I think—one estimate was presented that casinghead gasoline could be expected to reach the proportion of something like 1½ per cent by volume of the total crude oil which we produce. In actual fact it now approaches 6 per cent, while it amounts to about 13 per cent of the gasoline produced in refineries. And these ratios speak only for casinghead gasoline. They do not take into account the now nursing infant sisters, ethane, propane and butane, being prepared for industry and sent to it through the kindergarten of the chemical arts, isolated domestic fuel requirements, etc., and bidding fair to add material proportions to the now existing ratios. However, we may now be at the peak of this volume ratio production. The preponderance of crude production now coming from deep levels employs gas lift to a great extent. The recycling of gas into the sand in this process of lifting oil has served to add probably 100 per cent to the otherwise normal output of casinghead gasoline.

In view of the current general practice of weight or gravity-price differential in the crude oil market, studies are now being made which may conceivably lead to abandonment of that practice now current of working continuously the re-cycled lift stream of gas for recovery from it of its casinghead gasoline. Should this abandonment follow as an economic turn in the great industrial structure of production and distribution of oil and its products, the consequent reduction in supply of casinghead gasoline would be immediately felt, and with what consequence it would be difficult to predict right now.

There was a time when it appeared momentarily that casinghead gasoline might assume a place of special importance and price favor due to its appropriate and essential place in the production of anti-knock grades of motor gasoline. How essential this place was and is to be remains to be seen, in view further of the assumed current evolutionary stage of the art of cracking methods of crude oil fractionation. But a reasonable assumption may be taken that final adjustment of the structure of relative values as affecting the casinghead fraction may not have been reached yet, after 20 years. Such is the nature of petroleum in commerce; nothing finally settled; and how true this reflection is, is evidenced just out on the horizon where the Diesel engine stands ready to make its entry into the vast field of light motor duty. One turn continually suggests another, and what far-reaching consequences may not the announcements of preparation to distribute Diesel fuel to retail trade portend? But without diverging too far from the subject, review is interesting. By contrast comparisons become fascinating. Early casinghead gasoline was a composite of six or more fractions having initial boiling points as low as 32 degrees Fahrenheit against about four fractions and 90 degrees today. Color and odor and corrosiveness were neglected in the beginning; now they are rigidly controlled. Vapor pressures were unrecognized and neglected; now they are known and strictly controlled within safe limits. And where the product was restricted through narrow channels of distribution, it may now be said to appear in notable percentage in every channel and

18 OF THESE Prescott Pumps

The Andian National Corporation, Ltd., Toronto, Canada, installled 18 of these 30,000-barrel Prescott Pipe Line Pumps in Colombia, South America.



installed on one line

THIS South American installation of eighteen 30,000 barrel Prescott Pumps is a good indication of the wide reputation enjoyed by these dependable, favorably known pumping units. They are built strong and powerful to take care of high pressures and heavy overloads as well as ordinary oil pumping requirments. They are always on the job no matter how difficult the conditions.

Prescott Pumps are of the reciprocating type and they do their work economically. Power consumption is very low and maintenance almost negligible. You'll find the latest information on these pumps of practical value. We'll be glad to send our catalogs, performance data, etc., on request. Naturally there are no obligations.

THE PRESCOTT COMPANY

Menominee, Michigan, U. S. A.

Pumps for deep mines ~ Pumps for pipe lines

When writing THE PRESCOTT COMPANY *please mention The Petroleum Engineer*

usage to which gasoline is distributed. Where it was feared, shunned and anathematized by the refiner and distributor of oil products, it is now welcomed and utilized universally.

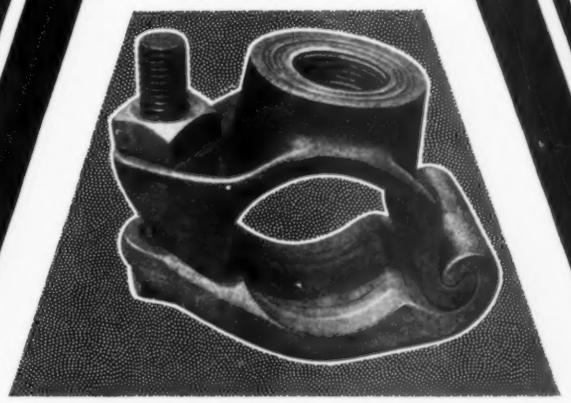
Likewise may be contrasted the limits and methods and the utilities of production of the product. It was sufficient and possible only to know it was present in commercially recoverable quantity; to this information we now add prediction of quality and any notable variance of characteristics due to prevail. Machinery and facilities for production, inappropriate and ill-adapted as they were, were largely salvaged from lease materials. They could be adapted only to the production of the crude composite above mentioned. Now this machinery and the facilities specially designed, modified and adapted to the sole requirement and the refinements embodied provide means for fractionation to any required degree and for treatment and purification to any and all rigid specifications that may be desired or imposed. Laboratory control was only contemplated and hoped for; today it is part and parcel of the ordinary procedure. Most astonishing of the contrasts, however, is this: We thought old stripper wells and settled pools of production to be the potential source of supply. Today we know the flush, new pools and fields of production to be vast potential new sources of production, available immediately and currently with the crude output. And as progress in handling and usage of the product demanded weathering or stabilization, we effected this with loss and inefficiency amounting to heavy percentage of loss of gross yield. Today the same end is realized without loss and with a degree of refinement and efficiency notable in its consequences. Indeed, it may be stated that through the exigencies of the casinghead gasoline branch of the industry, the art of fractionation has had a very large impetus reaching to a degree of present accomplishment no less surprising than are many of the modern advancements of the arts and sciences.

Also outstanding predictions may be made, through accomplishments of casinghead gasoline, for radical changes in economy of gasoline transportation. The pipe line will supersede the rail trunks, and shortly the rail tank will be relegated to local and short-haul service. Long since the casinghead plant has demonstrated that it ships its gasoline, most difficult of all to so transport, through any reasonable distance and under any reasonable limit of pressure through pipe line, ideal in point of economy and efficiency.

There was from the beginning an outstanding feature attending casinghead gasoline. It held a sustained fascination for the student-minded class in contact with the industry. It offered a rather wide combination of problems, chiefly physical in character, involving practically all of the gas and vapor laws, the laws of solutions and of energy and combustion, and of thermodynamics, many of which require further elucidation and further invite the attention and activity of the student. As a consequence, the colleges have, through faculty and student, devoted special interest to the industry and its subjects, and the benefit is to be noted not alone in results applicable to casinghead gasoline but to allied branches of art and industry as well. More is to come and the field is still open, more especially now from the angle of the chemist, where is opportunity for his patient and time-consuming researches.

Twenty years hence we may anticipate that, if the contrasts be not so striking in character, they will be, likely, in importance to advancing progress for the luxuries and perfections of civilization.

SKINNER



Service Saddle

for **service connections on oil and gas**

Designed expressly for the industry. The pressure platform concentrates pressure on the gasket, while sliding skids on the lower half of the saddle prevent tilting and bring an even bearing to the rest of its contact with the pipe. When you use a Skinner Service Saddle, the pipe is supported, the installation is rigid, permanent. Made of malleable iron.

Write for New Catalog 29-O

M. B. SKINNER COMPANY
Sample St. at Falcon St. SOUTH BEND, IND.

When writing M. B. Skinner Company, *please mention The Petroleum Engineer*

CARE NEEDED in Lubrication *of* Air-Lift Compressors

SINCE the introduction of air and gas lift plants on a large scale in the Greater Seminole area of Oklahoma and its following widespread adoption in most of the new oil fields found since that time, there has been considerable discussion on obtaining efficient and economical lubrication of compressor cylinders.

Many superintendents have complained of trouble from sticking valves and wearing of rings. This has been especially true where wet gas is present. This can be overcome only through careful selection of the oil used and the exercising of care in tending to the machines.

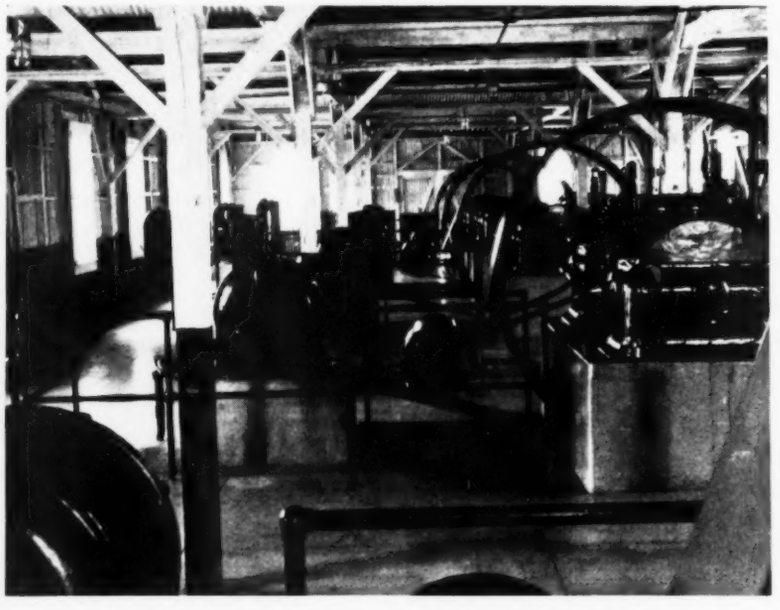
The lubrication of compressors demands several things in addition to merely lubricating the moving parts. The requirements are severe, but they appear to have been met in several instances, at least to a satisfactory degree.

The requirements demanded of an oil, if it is to give satisfaction under the conditions encountered in flowing wells by compressed air or gas, have four outstanding characteristics, as follows:

1. To give good lubrication:

2. It should not "cut" to any appreciable extent when wet gas is present.

3. It should have a color such that gasoline resulting from the operations would not be badly discolored. 4. It should have a viscosity and flash point that would withstand high temperatures.



One of the Texas Company's compressor plants in the Burbank, Oklahoma, field.

We are all familiar with the first requirement, since it is the same made by any power engine of lubricating oils. The third requirement practically explains itself, since discolored gasoline necessitates additional treating.

The second requirement is a very important one. The cutting action of wet gasoline has brought about the need for an oil that will withstand this cutting action. In several cases a straight petroleum product has been of little avail for lubrication of cylinders in compressors where wet gasoline is present. It is difficult to say just when such a condition will be brought about by the percentage of gas reaching this point. When very wet gas is encountered many plant operators have found a castor oil satisfactory.

The high temperatures encountered in compressing air is another question involved, besides wet gas, if good lubrication is to be obtained. The oil is subjected to oxidation because in its work of lubricating the compressor it comes in contact with the highly heated compressed air.

If an improper oil or an excess amount be used, the result of oxidation will be the formation of carbon deposits on the pistons, valves and in the discharge pipes. These deposits spell danger.

The greatest danger is perhaps in the valves, which work at high speeds. A slight deposit may cause them to work sluggishly or to stick together, which causes the air to be drawn back into the cylinder again and be recompressed. This gives rise to a very serious and dangerous condition because of the subsequent heating of the valves and surrounding parts. A temperature of 700 to 800 degrees F. or more may be reached under these conditions.

Since this is above the spontaneous ignition temperature of a mixture of oil vapor and air, the danger can readily be seen. These carbon deposits may become incandescent and any surplus oil is likely to vaporize and perhaps explode. Deposits in the discharge lines might cause the same thing to happen. Consequently, only the right amount of the right kind of lubricating oil should be used for lubrication of compressors—a matter that takes the attention of an experienced chemical engineer.

The use of oil very sparingly is the best way to guard against trouble or the risk of explosions, which unfortunately occur now and then. The oxidizing effect of the air when too much oil is used readily forms petroleum acids from the unsaturated hydrocarbons combining with the oxygen. These acids attack the copper tubes in the cooler and shorten their lives by eating them away.

Sometimes sticking valves and also liner wear are aided by the injection of a slight compound to the correct oil. Where water is present in large quantities in the compressor cylinders this is especially true. The compound offers a better seal and consequently air leakage past pistons and

Anchored to your tools

Does'nt chip off BLACKOR bonds perfectly and becomes with the steel part of the steel

BLACKOR'S high melting point permits its bonding into the steel to which it is applied. It does not merely flux over the steel surface but the molecules interlace with those of the steel, leaving no cleavage crack, and making it practically impossible to chip or break off. Blackor cannot crumble away from the metal to which it is fused and a part of the tool itself would have to break off before the Blackor could fracture.

Blackor resists abrasion to the greatest degree because it is the hardest abrasion-resistant material known and is applied over the entire abrasion surface of the tool, providing a solid wall of protective armor that repels abrasion. Blackor-ed tools dig more hole at less cost. Step up production and aid your crews by adopting Blackor as your standard hard facing.

BLACKOR COMPANY

Head Office: 13,007 South Main St., Los Angeles, California
New York Export Office: 39 Cortlandt Street
Tulsa Oklahoma Office: 410 Thompson Bldg.
Houston, Texas Office: 616 Public National Bank Bldg.

Licensed under Paten Numbers:

1,613,942	16,347
1,424,536	15,311
359,925	2,580
30,021	1,069

Reissue No. 17,323
Other Patents Pending

PROTECTED BY AMERICAN PATENT PROTECTION CORPORATION

BLACKOR

The Super Abrasion-Resistant Facing

When writing BLACKOR COMPANY *please mention The Petroleum Engineer*

Pump with

ELECTRICITY

Here's an Electric Pumping Unit that anyone can install. You counterbalance the load like a pair of finely balanced scales, so that a very small motor does a tremendous lot of work while consuming a minimum of "juice." The lift is straight. There is no vibration, no apparent effort. There seems to be literally no "wear-out" to it!

This Jensen Electric Jack is the despair of all competition, and the joy of all producers who have tried it. Mounted as it is, on the finest of bearings, it works away from one year's end to another without attention, without repairs, without adjustment. Not a motor has ever failed. The gears run in a bath of oil. It's a jam-up job.

There is a size to fit your wells. If electricity is not available we can furnish the unit gas-engine equipped. Why not write us now for further information?

JENSEN BROTHERS MFG. CO.
COFFEYVILLE, KAN., U. S. A.

Export Office: 136 Liberty St., New York
Stocked by THE THRIFT CORP., Houston

Dunigan Tool & Supply Co., Breckenridge, West Texas representatives

Petroleum Equipment Co., 2800 S. Alemeda, Los Angeles, California, representatives

JENSEN JACKS

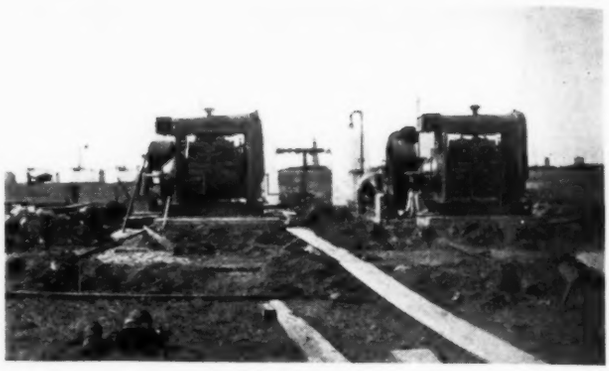
—AND PUMPING UNITS

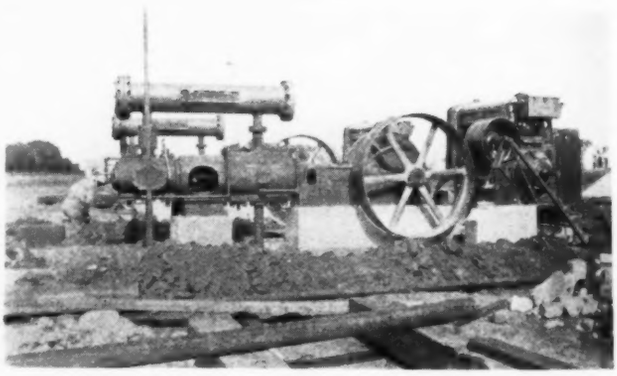
TIMKEN BEARING EQUIPPED

valves, which always produces high temperatures, will be considerably reduced.

After seeing that the correct amount of oil is used, one of the best practices is to keep the intercoolers and oil separators drained regularly. This prevents the accumulation of water and oil, that otherwise would probably be carried over to the last air stage, where due to small clearance and the high pressures the cylinder might burst.

Insufficient attention is often paid to the intercoolers, where due to scaling or mud the water jacket spaces often have been closed. This brings about a condition that causes more oil to be used on the power cylinders. Therefore, the





Three scenes showing primary stages of compressor plant construction.

water cooling space should be clean and an ample supply of clean water to cool the intercoolers available.

While not coming into the subject of lubrication of air-lift compressors, something to which much attention should be paid is to the air drawn into the cylinder to be compressed. There is nothing worse for forming carbon than dust. As much dust as possible should be filtered from the compressor intake and excluded from the cylinders of the compressors.

The plant operator should see that as much be done as possible to aid the oil in giving good lubrication, as under the best conditions it has a tough job in meeting the demands made of it for lubricating air-lift compressors.

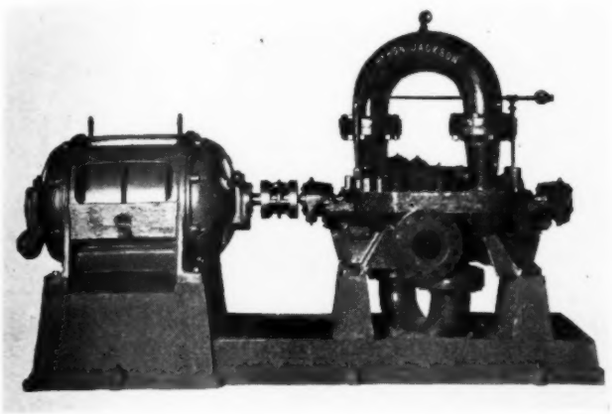
When writing JENSEN BROTHERS MFG. CO., *please mention The Petroleum Engineer*

Sinclair Installs New Type Pump

A NEW type of centrifugal pump designed for higher operating efficiencies is one of the features connected with the building of a new 10-inch oil line connecting the Oklahoma City field with the Sinclair Pipe Line Co.'s main trunk system. Four such pumps have been installed.

At the Oklahoma City station two are connected in series, as they are at Payson station, and will handle approximately 42,000 barrels daily against a line pressure of 650 pounds.

The pumps are three-stage, 6-inch multiplex line pumps



designed to operate at a speed of 3,600 r. p. m. Each pump is directly connected to a 400-horsepower, 2,300-volt, 60-cycle, three-phase motor. While the motors are large for the present volume to be handled by the pumps, the large size was decided upon in case it is necessary to increase the capacity of each station by substituting new rotating elements for higher capacity and head. The pumps are directly connected with a flexible coupling.

One change in the design of the unit over previous models of similar capacity is the double discharge bends, one of which sweeps over the top of the pump and the other beneath. The low stage has a double suction impeller and discharges into the bend going over the top of the pump to the second stage. The second stage discharges into the bend underneath the pump, which is the suction for the third stage.

The design of the double suction on the low stage eliminates the necessity of mechanical balancing device, and in conjunction with the design of the second and third stages gives the pump an improved balance. The overhead and underneath discharge bends are designed to give the pumps better efficiencies. The metho dadopted for hydraulic balance has been so satisfactory on tests that no mechanical thrust arrangements are considered necessary.

The base plate is clean cut in design, with a drain lip around the pump. This drains into a drain sump cast in the base plate, and which is bored for a nipple connection to drain off the sump accumulation. The pump is connected for a water cooling system on the bearings and glands. The packing lubrication is cared for by oil taken from the first stage.

A feature in maintenance is that the halves of the pump are bolted together with large acorn-head bolts. The lubrication, water lines, suction and discharge nozzles are on the bottom case of the pump to make it unnecessary to disconnect them when the top half is removed.

Completion of this line out of the Oklahoma City field will bring the capacity of the Sinclair company to around 60,000 barrels daily.

Oil Men Who Prefer the Best « « « « Demand McEVOY PRODUCTS

Into oil field operations today has swept a realization of the fact that quality products bring greater profits in the long run. Oil executives have come to recognize the great investment which a well represents and have quickly insured and protected that investment by being careful as to the kind of equipment they put in their wells.

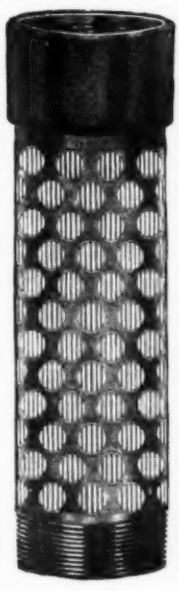
Backed by over 28 years of practical engineering and oil field experience the name McEVOY on a product means the very best that money can buy. McEVOY PRODUCTS are demanded by the particular oil executive for they greatly lessen the element of risk.

Write for Complete Catalog

◆

J. H. McEVOY
& Company
Houston, Texas ' ' ' U. S. A.

◆



The McEVOY STRAINER has always been the choice of oil executives whose experience has taught them the value of the right screen to insure future production of the well.

◆

McEVOY UNIVERSAL TUBING CONTROL HEAD ready for hook-up through tubing any size from 2" to 6⅝" with casing 4½" to 13⅜". It is truly "universal," for it meets every need of the well from "drilling-in" to "pumping." Tested 2500 pounds per square inch.

With the NEW CP "Tucone" ROCK BIT

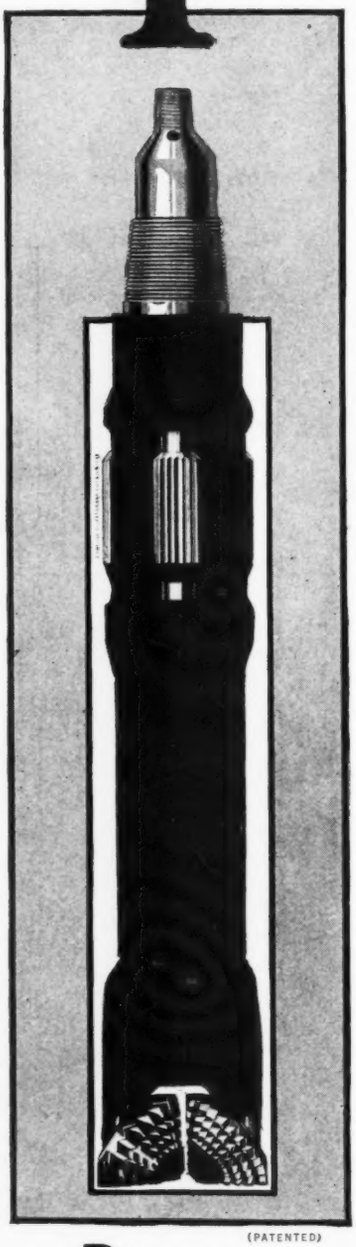
CIRCULATION!

Fluid stream jets directly on bottom of hole. No side-wall hydraulicking!

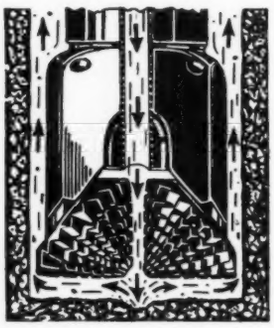
STRAIGHT HOLE!

9 POINTS OF SUPERIORITY

1. **SAFETY**—Extra large drop-forged spindle bearings. No cone bushings. One-piece bit head. One-piece reamer body. FISHING ELIMINATED
2. **CIRCULATION**—Fluid stream jets directly on bottom of hole. No side-wall hydraulicking. STRAIGHT HOLE
3. **CLEARANCE**—Over 34% of hole area is clear. "Balling up" eliminated. STRAIGHT HOLE
4. **CONES AND SPINDLE BEARINGS**—Cones run on extra large replaceable drop-forged spindle bearings. Stronger and thicker cone wall section due to absence of bushing. GREATER STRENGTH
5. **REAMERS**—Three units, properly spaced and located for accurate reaming. New type reamer bearing eliminates wear on reamer body. KEEPS GAUGE — ALWAYS!
6. **ONE-PIECE BODIES**—Both bit and reamer bodies are solid manganese steel. GREATER STRENGTH
7. **REPLACEMENTS**—Cone-and-bearing units and reamers easily and quickly changed. TIME SAVED
8. **LOW MAINTENANCE**—Body repairs eliminated. No wear on bit head or reamer body. MONEY SAVED
9. **CONE SERVICE**—New CP "Red Head" cutting cones can be refitted on your used bearings (only at authorized CP Service Stations) and guaranteed by CP to be as good as if a new bearing were used—at a great saving to you! ECONOMY



(PATENTED)



Showing unobstructed fluid stream jetting directly on bottom of hole and promoting proper expulsion of loosened structure.

THE cutting cones are SEPARATED to a scientifically determined degree. Their position allows the fluid stream to jet directly on the bottom of the hole and promotes the proper washing of the loosened structure for expulsion. (See illustration above.) Due to this lack of obstruction of the fluid stream, there is no SIDE-WALL HYDRAULICKING, no undue pressure exerted upon the sides of the hole to cause side-hole washouts and lead the bit from its true, vertical course. CROOKED HOLES, DUE TO SIDE-WALL HYDRAULICKING, ARE ELIMINATED!

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: Chicago Pneumatic Bldg., 6 East 44th St., New York

OIL TOOL DIVISION OFFICES:

OKLAHOMA CITY, OKLA. — 655 Santa Fe Ave., LOS ANGELES, CAL.

KEEPS GAUGE ...ALWAYS! OT-12

That the use of CP "Tucone" Rock Bits will unquestionably result in lower drilling costs, we are ready and willing to prove in any way YOU say! An inquiry to any of the above addresses will receive immediate attention.

When writing CHICAGO PNEUMATIC TOOL CO. *please mention The Petroleum Engineer*

Chemicals Employed in California Fields for

Testing Formations for Colorless Oils

By P. C. McCONNELL, *District Petroleum Engineer, Standard Oil Co. of California*

A DESCRIPTION of the method now used for the detection of colorless or light-colored oils in samples of formations now being encountered in several California oil fields may be of interest or value to others. The method may have been used previously in other areas, but the writer has been unable to learn of such practices, either through discussions or the perusal of current literature. Accordingly, at the risk of repeating the description of a simple but very effective operation, this discussion is now submitted.

In some parts of California, colorless oils and oils having an extremely light color have been difficult to detect while drilling formations. Mr. McConnell describes a method which has proved valuable for testing formation samples under these conditions.

In 1928, when the Milham Exploration Company was drilling what proved to be the discovery well of the Kettleman Hills field—"Elliott" No. 1—the temblor formations encountered were logged as predominantly hard gray sand and sandy shale. Mention was made quite frequently regarding the presence of gas, but the gray sands continued to be regarded as probably water-bearing, with, in a few cases, very slight evidence of the presence of oil. Washing of core samples with the usual solvents, such as chloroform or ether, produced a very slight amber color from only an exceedingly few samples of formation.

Soon after the unexpected "blowing-in" of this well in October, 1928, it was realized that these apparently barren sands actually formed a great reservoir containing not only gas, but also large volumes of a colorless or faintly colored oil of unusually high gravity.

With the active development that was launched immediately following the completion of the discovery well, investigations were started for the purpose of developing some method whereby the operators in the field would be able to determine whether or not the sands encountered in drilling were oil-bearing. Inasmuch as the oil was practically colorless, it obviously was impossible to detect its presence by the discoloration of the common solvents, such as ether and chloroform.

The first chemical treatments of the sands considered were found not entirely satisfactory, because of the time and amount of equipment required for the tests. During the course of the investigations a field petroleum engineer of the Standard Oil Company of California learned of the use of the organic compound, acetone, in the detection of gasoline as an impurity in certain liquid preparations. Upon his suggestion, experiments were made that resulted in the present accepted use of acetone in the detection of colorless or extremely light-colored oils in the cores taken from the producing sands in Kettleman Hills. The present acetone test was developed by this petroleum engineer in collaboration with another petroleum engineer and a chemist of the same company, to whom the writer is indebted for comments regarding the action of the various substances involved.

For the benefit of those who may be interested in the physical nature and chemical composition of acetone, the following notes are offered:

Acetone is an organic compound, and the simplest representative of the alphatic keytones, its chemical formula being CH_3, CO, CH_3. It is a colorless and rather fragrant fluid, highly inflammable and quite volatile. It boils at 133 degrees F. and has a specific gravity of about 0.8.

Acetone is prepared in several ways, being derived from several acetates, from acetic acid, and by certain fermentations of starchy materials. It has long been used in numerous chemical processes and is involved in the manufacture of artificial silk, cordite and chloroform. It possesses two properties that give it especial value in the detection of oils. First, it is infinitely soluble in water, and secondly, it is a ready solvent of fats and oils. On the basis of these properties the following test for colorless oils has been prepared:

A sample of the core to be tested is loosely ground in a hand mortar, placed in a small beaker and washed with acetone. The common practice is to use about 15 cubic centimeters of acetone to wash about 20 grams of formation. The sample is thoroughly stirred in order to allow any oil present to be dissolved by the acetone. The contents of the beaker are then poured into a filter paper and the filtered acetone drawn off in a test tube. This filtrate consists of colorless acetone in which is dissolved the oil that was present in the formation sample.

To the filtrate is added an equal to a double volume of water. If oil is dissolved in the acetone, the solution takes on a cloudy to opaque appearance, the degree of the cloudiness being a rough criterion of the amount of oil originally in solution. If there is a comparatively high percentage of oil present, it may form a small globule on the surface of the liquid. In the absence of oil no change is noted when water is added to the acetone, the solution remaining water white. An idea of the amount of oil present also may be obtained by adding the water to the acetone slowly and noting how rapidly the solution begins to cloud. The greater the amount of oil in the acetone solution, the less the amount of water required to produce cloudiness. If oil is present in small amounts only, it will not appear until a comparatively large volume of water has been added.

It may be seen that the two properties of acetone previously mentioned have formed the basis for the test. In the first step the acetone dissolves and collects the oil. In the second, this oil is thrown out of solution by the addition of water, due to the insolubility of the oil in the resulting water-acetone solution. The oil is expelled from the solution in the form of minute globules, giving the cloudy ap-

Additions to » » » » *Your* Warehouse

You are invited to consider the comprehensive stocks of pumping equipment maintained by Norris Brothers at Fort Worth, Tulsa and Owensboro as a convenient part of your own warehouse facilities. Twenty-four hours after "requisitioning" a product, it will be on your lease, ready for use.

This service represents a number of important advantages—

1. ***It enables you, if desired, to reduce your own inventory.***
2. ***It assures you of the very highest type of pumping equipment (balls and seats, DROPS and seats, turnbuckles, standing valve pullers, etc.)—equipment known throughout the oil world for its uncompromising quality.***
3. ***It guarantees almost immediate delivery, no matter how large or how small your order.***

These facilities have been provided for *your* convenience. Mr. H. J. Allen at Fort Worth, W. E. Sexton at Tulsa and G. W. Hall at Owensboro are all ready to give you, in addition to dependable products, the prompt and personal service to which you, as a user of NOR-BRO products, are entitled.

NORRIS BROTHERS

INCORPORATED

Robinson, Illinois

Fort Worth Owensboro Tulsa

pearance to the liquid and, in some cases, if sufficient oil is present, oil will collect on top of the solution.

The advantages of this test are more or less evident:

1. It is simple and does not require the service of a specially-trained man. Merely washing the sample with acetone, filtering, and adding water, can be done by anyone in the field.

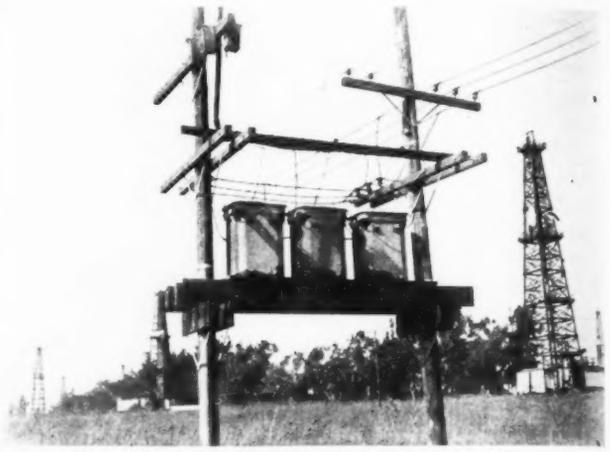
2. The test can be performed very easily in any field office or even at the well.

3. It requires very little apparatus; a mortar, a beaker, filter papers, a funnel and a test tube.

4. Of more importance is the fact that it requires very little time, permitting rapid determinations during the process of drilling.

5. Of still greater importance is the fact that it is a positive, reliable and very delicate test, giving no false indications, so far as known, because of other substances in the cores, but showing the presence of extremely small amounts of oil. The presence of dry gas has no effect, but the light oil fractions carried by wet gas are readily noted.

It has been reported that in a few instances brown shale samples, apparently barren of oil, have shown oil indications when treated with acetone, but the petroleum engineers of the Standard Oil Company have been unable to verify this fact in their field investigations. However, as it is recognized that traces of oil are quite common in certain shale bodies, these indications in no way discredit the value of the test.



Typical transformer installation to serve wells.

In connection with the actual development operations of the past year, the acetone test has been found always to be reliable and in every way satisfactory. It is felt that it can be used to advantage where tests for colorless or light-colored oils are required.

A. C. Picard Dies

MEMBERS of the oil fraternity were shocked to learn of the recent death of A. C. Picard, who for a great many years had been manager of the Lubricator Division of McCord Radiator & Manufacturing Co., Detroit, Mich. Mr. Picard enjoyed an exceptionally wide acquaintance in the industry. His passing is deeply regretted.

Missouri-Kansas Pipe Line Makes Contracts

Announcement was made today by Missouri-Kansas Pipe Line Co. that contracts have been released for immediate construction of a $40,000,000 natural gas pipe line, 1,250 miles long, running from the Panhandle field in Texas to Indiana, via Kansas City; Springfield, Illinois; Terre Haute and Indianapolis, and connecting with the company's Kentucky pipe line system at a point near Evansville, Indiana.

A Real Substantial, Durable Value for

Sulphuric Acid—Sludge Acid and Separated Sludge Acid

CAROLINA ACID VALVES

Made of Various Alloys to Suit Your Acid Conditions

ADVANTAGES

Valves are furnished in either straight line or angle type.
Plugs and seats both renewable.
Rising Stem.
Extra good stuffing box with special acid resisting packing.
Extra heavy construction throughout.
Stuffing box can be packed when valves are either open or closed.
Longest life valve made with the least maintenance and operating trouble.

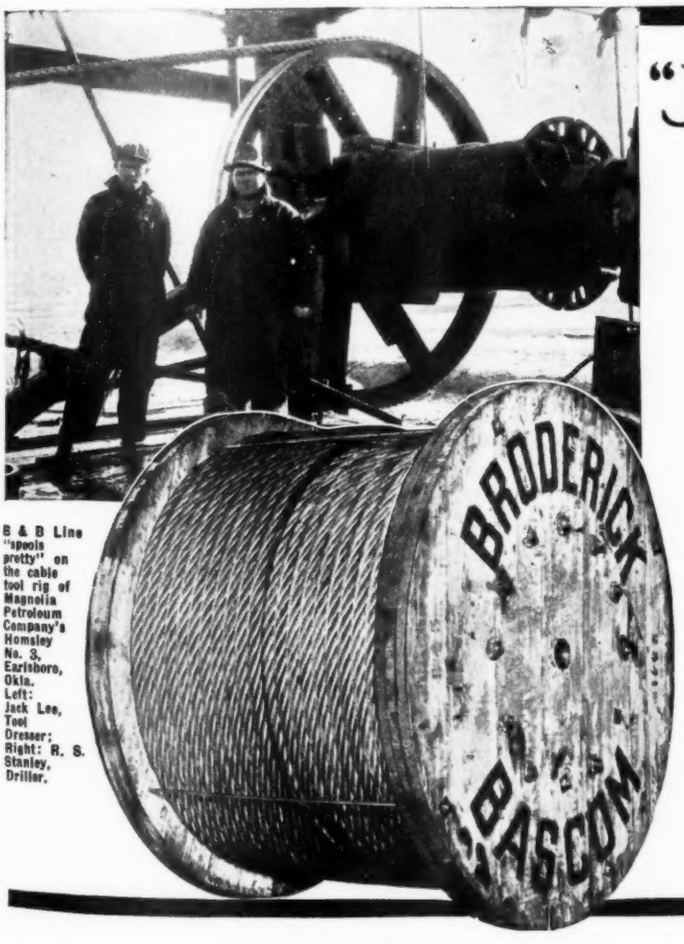
Special Equipment for Chemical Plants

Acid Valves
Automatic Cut-off Valves
Acid Pumps
Chemical Brick
Acidproof Cement
Chemical Putty
Oil and Gas Burners
Quartz for Acid Packing
Lead Alloy Plug and Seats
Acid Airlift Systems
Special Alloy Equipment
Charlite Cleaner

Designed by Engineers With 25 Years Experience in Acid Plants

CHARLOTTE CHEMICAL LABORATORIES

CHARLOTTE, N. CAROLINA NEW YORK OFFICE—50 E. 42 ST.



B & B Line "spools pretty" on the cable tool rig of Magnolia Petroleum Company's Homsley No. 3, Earlsboro, Okla. Left: Jack Lee, Tool Dresser; Right: R. S. Stanley, Driller.

"Just Naturally A Good Line"

Listen to R. S. Stanley, Driller, calling down Jack Lee, Tool Dresser, for saying they have good luck with their *B & B Cable Tool Drilling Lines:* "Good luck, your eye! It's just naturally a good *line.*"

***Naturally* it is. The wire is specially drawn and put through four very strict tests. It is laid up on machinery designed to impart to the rope that *springy* quality which makes drillers call it "the easiest handling line made—a mighty pretty spooling line that you can count on to drill ahead of the tools."**

Distributors in all fields handle B & B Patentsteel, Extra Strong Cast Steel and Cast Steel *Cable Tool* Drilling Lines, Sand and Pumping Lines, and invincible Yellow Strand Rotary Lines.

Send for Catalog 53

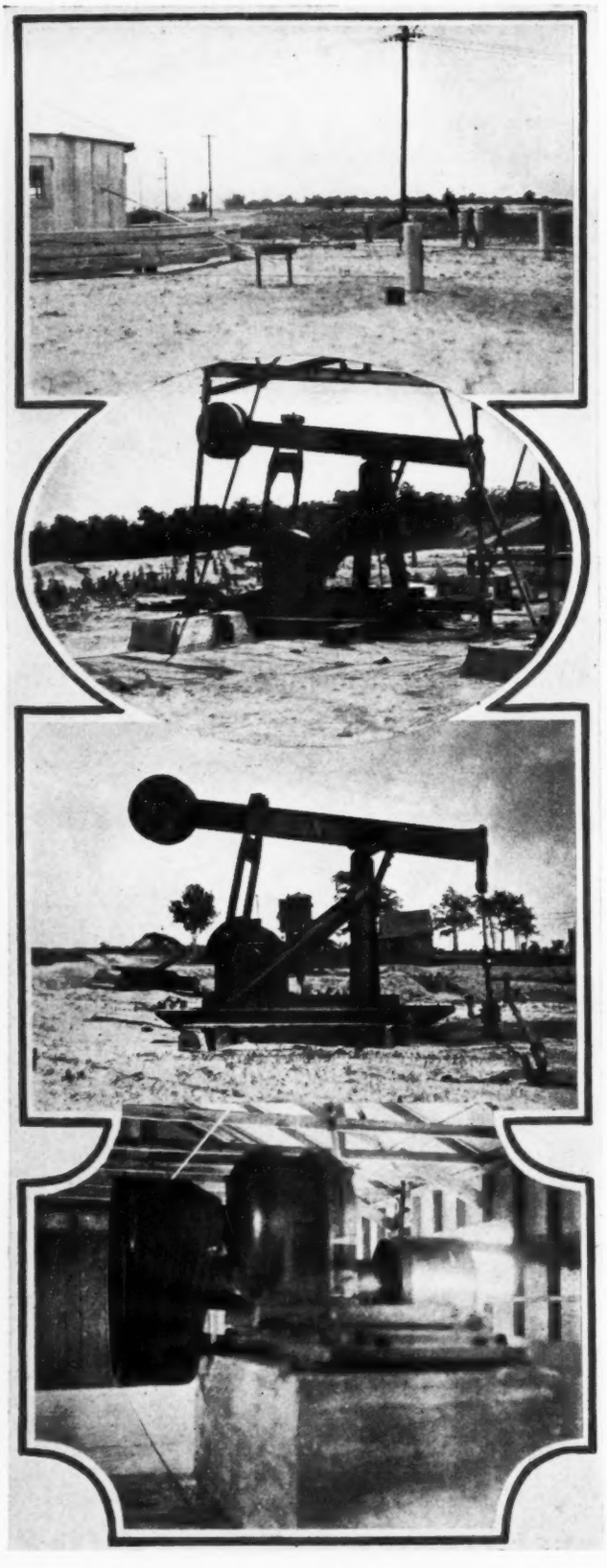
BRODERICK & BASCOM ROPE CO.,
St. Louis, Mo.

Factories: St. Louis and Seattle Warehouse: Houston

BRODERICK & BASCOM DRILLING LINES

NR696

Good Record Made by Electrical Pumping Equipment



Top to bottom—A view of one of the central powers, showing circular shape of back of station to accommodate band wheel. Individual electric unit working on location with a derrick, but without any foundation. Close-up of one of the individual electric motors. Electric texrope drive motor in one of central power plants on Benedum-Trees property in Beebe field.

THE Benedum-Trees Oil Company utilizes electricity for pumping its wells in the Beebe field, northwest of Ada, Okla. In this installation the electric equipment has proven quite satisfactory in being free from operating troubles and has proved an economical means of bringing the oil to the surface.

The company has 27 pumping wells in the pool. Three big central electric powers furnish the means of pumping all but three of these wells. These three wells are pumped by means of an individual electric unit.

The individual electric units are a feature of the several interesting pieces of electric equipment that E. G. Kendall, superintendent, has installed. The motor is a small upright cylinder-shaped device. It is a 10-horsepower motor, which is so compact that it is placed on the stirrup-head of the jack, which it operates by means of a flywheel. The motor is connected to the electric current by means of an extension line. This line passes through a switch, similar to one in a domestic home, that permits the turning off or on of the power by merely pressing a button.

One of these small individual motors was installed on the company's Mole 6, section 31—5n—5e, on about November 1, 1929. Since this time the unit has made an excellent record for economical lifting costs. The well has produced, since this time, a total of 56,000 barrels of fluid, of which 46,000 barrels was oil. The cost has been about $450.00, including the extending of the electric line and the electric current consumed. During this time not a cent has been spent on repairs.

This well, like others in the area, has a depth of around 2,650 feet. It is tubed with two-and-one-half-inch upset tubing and three-quarter-inch sucker rods, and a pumping jack. It is pumping with a 42-inch stroke at the rate of twenty strokes per minute.

Another economical feature of the operations is the lack of any jack foundation on the wells. The jacks were placed temporarily without foundation, but have been doing so well that no attempt has been made to construct foundations. In several cases the derrick has been skidded away, while in others it has remained, but in no case has a foundation been built. Two large wooden sills have been laid upon the ground, which is quite sandy. The jack is rested upon these. Despite the lack of a solid foundation, no trouble has resulted.

During the month from December 25, 1929, to January 25, 1930, the unit consumed a total of 3340 kilowatts, or about 107 kilowatts per day during that month. At this time the well was in a more flush stage than today, making 400 barrels daily.

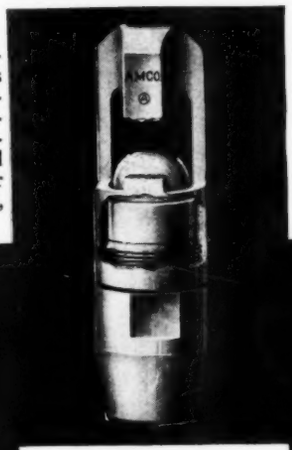
All of the other wells are pumped from bandwheel powers. Three central powers are equipped with 75-horsepower electric texrope-driven motors, turning a 24-foot bandwheel by means of a belt, giving 18 strokes per minute. These are built to accommodate 16 wells, but none of them is pulling to capacity yet.

The buildings housing these are rather unique in design. At one end is the motor, where the building is narrow. At the other end it has been widened and made into an oval shape to accommodate the bandwheel.

A feature of all the electric equipment is the smooth, vibrationless and quiet operation and the ease with which the small individual motor runs the pumping jack.

All-Steel

One of the most commonly used valves. Its complete assembly includes a steel standing valve body, bottom cage, and seat and ball, either Regular or Oversize, in tool steel, Axloy or bronze.

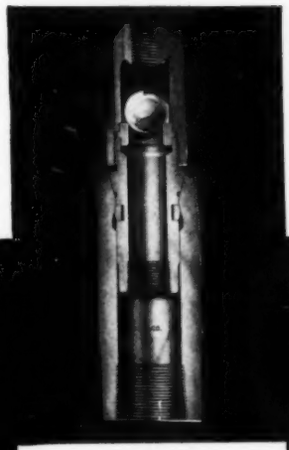


Super-Size

This valve affords from 44% to 89% increase in fluid passage area without increasing outer diameter of the cage and body.

E-Z-Pull

This valve is easy to pull, regardless of sand conditions. The valve, cage and body are integral. Lower portion of the cage body is tapered to fit standing valve barrel.

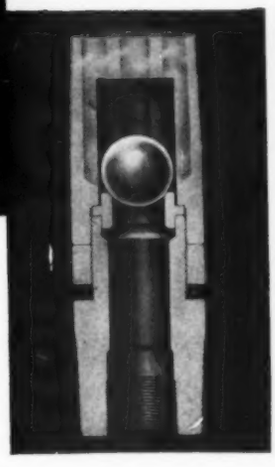


Ritter

An expanding steel lock ring in this valve engages the barrel, preventing floating, sticking or traveling of the valve.

Barrel-Bottom

An extremely rugged valve. Interior of the cage is equipped with ribs and guides, keeping the ball in vertical travel at all times.



For an *infinite* variety of efficient pump Combinations

Axelson Standing Valves

FIVE types of Axelson Standing Valves are offered, each of which has been time tested. Selection of these valves to meet particular conditions in your well assure proper service.

The five types are, namely — All-Steel, Super-Size, E-Z-Pull, Ritter and Barrel-Bottom.

These valves are made from bar steel and are interchangeable.

Axelson Manufacturing Co., Ltd.

P. O. Box 337 Tulsa New York City
Los Angeles St. Louis 30 Church St.

Mid-Continent and Eastern Distributors

Frick-Reid Supply Corporation

AXELSON STANDING VALVES

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

When writing AXELSON MANUFACTURING CO., LTD., *please mention the Petroleum Engineer*

Guaranteed

definite

Performance

IN THE LAYNE

MILLED GROOVE SCREEN

Promises for the *greater production Layne Milled Groove Screen* are based upon past performance records—not in just one case, but by large and important oil companies throughout this country and abroad.

Proven by actual, every day use, the *Milled Groove Screen* safely stands the full weight of 8000 feet of drilled pipe, and its remarkable tensile, collapsible and end strength was recently proven by Pittsburgh Testing Laboratory.

The exclusive greater production *Milled Groove Screen* recently set a record when more than half a million barrels of oil passed through one joint of the screen in three months.

Guaranteed definite performance, based on past achievements, is reason why you had better install *Layne Milled Groove Screen* instead of wishing you had.

•

Write, wire or phone for further information, catalogue or quick service.

The Layne & Bowler Co.

HOUSTON, TEXAS

The Layne New York Co. 30 Church St., New York — The Layne & Bowler Corp. Los Angeles, Cal. — Vickers, Limited London, England

Natural Gasoline and the Refiner

By R. B. HIGH, *Shell Pet. Corp.*[1]

I WILL not attempt to comment upon the papers presented before the recent annual meeting of the Natural Gasoline Association of America separately, as I prefer to group the complete subject under a general discussion. Summarizing the detailed specifications, we have seen that we are interested in:

1. Intermediate boiling points.
2. Volatility as expressed by some intermediate boiling point or by other emperical means.
3. Highest useful compression or anti-knock value.
4. Vapor pressure of the finished blend.
5. A. P. I. gravity to some extent.
6. And lastly, but indirectly, the cost of natural gasoline.

Some literature has been published on the effect of lowering the end point. This is of minor importance and is practically negligible on the higher percentage blends, while for the usual blends generally handled in the refineries it may be disregarded entirely.

It isn't necessary to go into further detail in the effect of natural gasoline on the intermediate boiling points or volatility. These effects can be readily calculated when the distillations of the components are known, and the finished blends will follow a straight line relationship with extreme accuracy.

I feel that the effect of natural gasoline on the anti-knock value of the finished fuel has been slightly overemphasized. It is entirely true that the usual grade AA natural gasoline has a good anti-knock value and will have its effect on the finished blend, but the refiner should not be misled into the idea that he can make a high-grade anti-knock fuel equivalent to the anti-knock fuels now on the market simply by the use of natural gasoline.

Gravity is still important to a few who are selling their product on a gravity basis, but is becoming less important as this requirement is dropped from ordinary motor specifications.

In looking over the above points it will at once become apparent that there is no definite limit to the results that can be obtained by blending additional natural gasoline. Intermediates can be lowered, volatility can be increased, gravity can be raised and the anti-knock value can be increased within a limited range.

The negative effect that comes in at this point is the vapor pressure, whereby any increase over a predetermined maximum will cause vaporlock and render the gasoline useless as a motor fuel.

I think I am safe in stating that all refineries are now primarily interested in marketing the best possible product with proper volatility and as high an anti-knock value as is possible with the materials at hand. With the volatility standard once set, the refiner is able to calculate the amount of natural gasoline needed, if any. In addition to this, he may calculate the quantity necessary to raise the finished blend to the maximum vapor pressure. If this quantity on any particular grade falls below the quantity necessary for volatility or any other intermediate points, a more stabilized product must be purchased. This enables the rough determination of the proper grade.

The more general case is where the quantity necessary for volatility falls considerably below the amount necessary for vaporlock. Thus the refiner is given a choice of a maximum and minimum which can be used. This is where the cost comes in, as he will certainly not use maximums under adverse price structures.

[1] A discussion of papers presented before the annual meeting of the Natural Gasoline Association of America.

We must also consider the specifications of natural gasoline at this point, which are particularly indefinite at the present time.

Up to a year or so ago a change in the natural gasoline specifications did not appear necessary, even though the vapor pressure was not stated, and even though it was considered by the general refiner that the specifications were more or less arbitrarily standardized by the natural gasoline industry to suit its particular conditions.

It was fully realized at that time that different grades were preferable for certain purposes, but equivalent grades were fairly constant in composition and intelligent blending could be carried on.

These conditions were altered by certain new fields coming in with gas of a high butane content, but improved efficiency in the gasoline plants, the manufacture of aviation and highly stabilized motor fuel blends and commercial solvents. The effect of these products was to create residual products which the natural gasoline manufacturer attempted to blend to the so-called "synthetic naturals" characterized by high butane content, high gravity together with high recovery.

Taking grade AA as an example, we may now receive materials with butane contents ranging from 20 to 40 per cent, and with gravities ranging from the low 80s to as high as 91 and 92 degrees A. P. I. Vapor pressures also vary under similar extreme ranges.

The convention papers have given us various methods for our blending operation, but the question will at once arise as to what basis can be used by a refiner to intelligently carry out a blending program under these conditions.

This may be diverging slightly from the subject of the three papers under discussion, but since none of the papers are specific in defining the commercial grades to be used it seems a good time to mention the possible variations which are not only possible but probable under the existing specifications.

The refiner is particularly interested in the composition of the natural gasoline he is purchasing and should be assured of the approximate composition before the arrival of the material. When a refiner ships a car of finished motor fuel the purchaser knows more or less definitely what he is to receive. There does not seem to be any reason why casinghead specifications should not be equally specific.

In reviewing this position it would appear that specifications could be built around the butane and pentane content and the vapor pressure. This does not necessarily mean that a natural of high butane content would be the least valuable, as it may be more valuable for certain blending operations. Each grade will seek its own price level based upon the law of supply and demand.

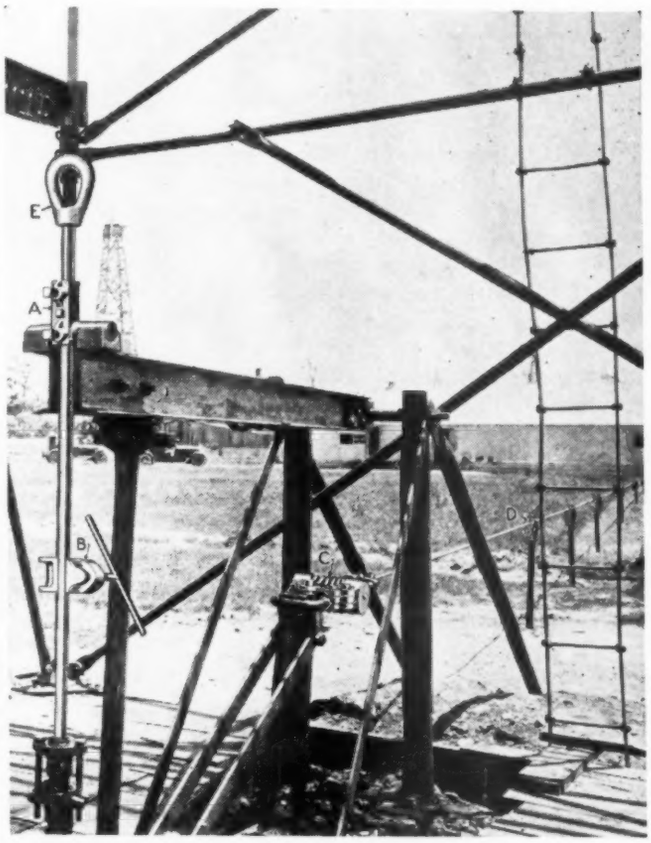
In Mr. Davison's paper I noticed that the specifications committee has selected 140 degrees F. with the vapor pressure as indication of the butane and pentane content. My personal feeling is that this temperature is perhaps too high and would not differentiate sufficiently between the components, and would make it possible to substitute butane for pentane in synthetic natural gasoline mixtures.

Skelly Oil Announces Expansion Program

COINCIDENT with completion of the details of the sale of $12,000,000 of 6 per cent preferred stock through a syndicate of New York and Chicago bankers, Skelly Oil Company announced an accelerated expansion program covering the next two years.

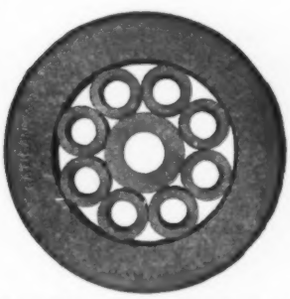
A new lubricating plant will be constucted at the company's refinery at El Dorado, Kansas. This plant will embody all the latest improvements and modern, scientific methods for the manufacture of lubricating oils.

A RATIGAN EQUIPPED JACK WELL



Equipped with the following Ratigan appliances: (a) No. 46 Reversible Polish Rod Grip, which can be used as shown, or turned upside down for Jensen or similar straight lift Jacks. (b) No. 2 Ratigan Spacing Clamp--universally known and used. (c) No. 5 Ratigan Shock Absorber. (d) No. 36 Ratigan Rod Line Roller--made to insert into end of tubular post. (e) No. 43 Polish Rod Lifting Eye.

No. 36 Rod Line Roller



View Showing Roller Bearing Construction

Write for Complete Catalog

J. P. RATIGAN

Manufacturer

1213 Santa Fe Ave., Los Angeles, Calif.' U. S. A.

New York Office, 30 Church St.

Cable Address, "RATIGRIP"
Los Angeles and New York---All Codes

When writing J. P. RATIGAN, *please mention The Petroleum Engineer.*

Some Phases of

Metering Oil *in* Pipe Line Systems

By HOLLIS P. PORTER, *Consulting Petroleum Engineer.*

A PIPE line system is referred to in this article to distinguish the difference between a single pipe line station and a system which includes several stations along a line which may receive or deliver oil at several points very much as a railway system may receive and deliver freight at its numerous stations.

Let us take a hypothetical system transporting oil from Oklahoma to the Gulf of Mexico. This system includes the usual telegraph system with operators at each station on the main line as well as at all the main stations of the branch lines. Each day all oil received from the various sources of supply is reported by wire to the various stations or to the main offices as occasion may demand.

The total receipts of the system plus, or minus, the sums of the over or short quantities found in the working tanks along the system gives the gross quantity of the oil received. To balance this gross quantity there must be taken the total deliveries made to storage. Shrinkage allowance, and deliveries to refineries or other places at the destination. All the accounting must be carefully done, and this involves much detail and requires that an accurate check be kept by gauging and metering all receipts and deliveries of quantities passing from station to station.

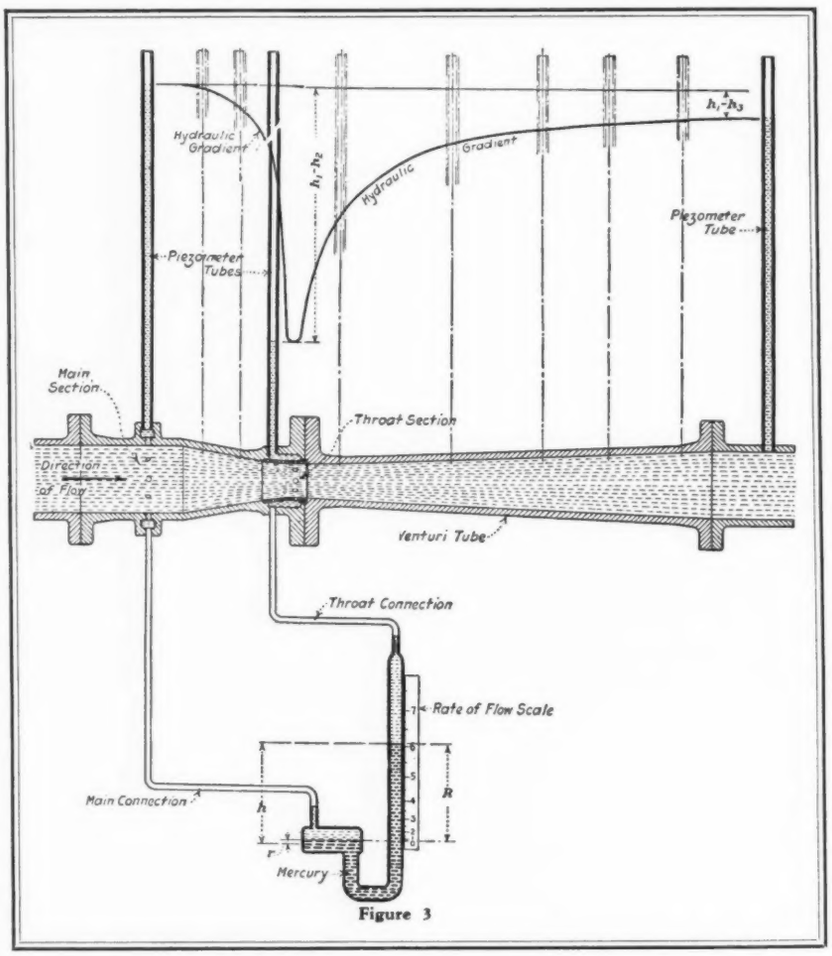


Figure 3

For many years the pipe line systems throughout the United States depended upon a method of gauging all tanks with a pole, or a steel line to record the quantities hourly along the main lines.

All oil received at each of the main line stations, which were approximately forty miles apart, was delivered into a large tank (usually 55,000 barrels capacity), while the station was pumping out another tank. It required someone constantly on the job at each station to do the gauging and much loss occurred due to evaporation, while oil was pouring into and standing within these large tanks.

Later an improvement was made when in the early years of the ninteen twenties, the device called a pneumercator was applied to the tanks at each station so that this instrument, placed within the operator's office, could be read to determine at any time the gravity and quantity of oil in each tank. This device reduced the manual labor and gave a better and more accurate gauge of the tanks, but it did not reduce the bookkeeping, loss by evaporation, etc.

During the years 1923 - 1924 the writer in charge of research, and at the same time, head of a department of one of the large oil companies in Oklahoma, joined with others of the pipe line department to form a committee to investigate ways and means for improving the operation of the pipe line system. At that time experiments were conducted which determined evaporation losses at each station. It became evident then that the losses could be very much reduced by use of meters on the receiving and discharge lines to the station and a surge tank floating between the incoming line and the meter and the station would take care of the over and short quantities. At first orifice meters were tried with some degree of success, but later the venturi meter was adopted, and it was found perfectly practical to calibrate the instrument to give results on oil within a very small error, and it is not considered necessary to keep a perfectly accurate record at the intermediate stations, because these stations check the runs principally for the purpose of detecting leaks that may occur between stations. It is possible to detect a break in a line almost instantly by the change in pressure and volume as shown on the venturi meter register. (See Fig. 1 for illustration of connection and register.)

Questions that may come to the mind of the reader may as well be considered here. He will naturally ask what

effect does the change in gravity make upon the meter? The answer to this is that there is a slight change due to change in viscosity, which is really the change that takes place when there is a change of gravity. In practical operation it is found unnecessary to consider an ordinary change of gravity which may occur. Current changes of viscosity which are usually due more or less to changes in gravity or temperature seldom create an error of over two per cent. The meter must be calibrated for oil of the average viscosity which will be transported. This is done by the manufacturer who furnishes the instrument. Should there be a permanent change of consequence in gravity, there is a small cam in the mechanism of the recorder which can be replaced by the manufacturers and the instrument will then be suitable for the changed condition.

A simple diagram, Fig. 2, illustrates a station with an intake meter connected upon the line at "M_1"; the surge tank "T"; the outgoing meter "M_2," registers R_1 and R_2 and the pumps "P."

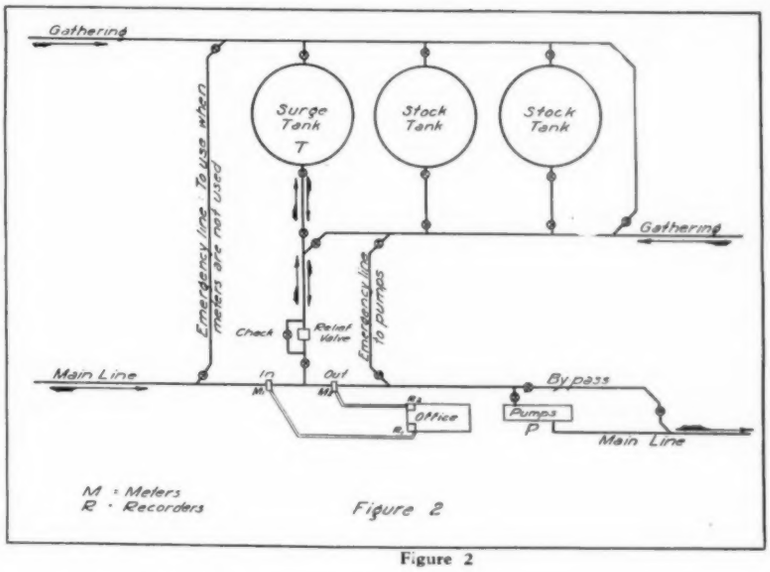


Figure 2

It will be noted that two small lines extend from each of the meters at the oil lines to the recording instruments which may be located at any convenient place in the operator's office. It is important, on account of the low pressure which prevails when the surge tank is nearly empty, to locate the surge tank so that the bottom of same is at an elevation approximately five feet above the registers R_1 and R_2. This is to insure a sufficient head to be effective upon them. The diagram provides lines for storing oil that are needed at only the larger stations. In any arrangement of meters there must be provided a means of checking quantities received or delivered from the station and the arrangement shown provides this. The quantity over or short in the surge tank added to or subtracted from either meter's reading gives a double check upon the quantity. The meters should be calibrated to read directly in barrels of 42 gallons so that the attendant will be required to do a minimum amount of calculating.

The Principle of the Venturi Tube

The late Clemens Herschel, who died in April just past, described in his original paper, which is published in the transactions of the American Society of Civil Engineers, November, 1887, and June, 1888, his experiments with two tubes which he named after Giovanni Battista Venturi, an Italian who in 1797 announced that fluids under pressure gain speed and lose head in passing through converging pipes and vice versa for diverging pipes.

The primary element of the complete venturi meter is commonly known as a "venturi tube" or simply a "venturi." It consists of a constricted portion which may be inserted between two flanges in a pipe line for the purpose of accelerating the fluid and lowering its static pressure, suitable pressure connections being provided for observing the fall of pressure which accompanies the increase of speed at the narrowest part or throat.

The proportions of the venturi tubes used for metering both liquids and gases are usually much the same as originally adopted in 1889 by Clemens Herschel and a typical form of construction is illustrated by Fig. 3.

Starting at the upstream flange, there is first a short cylindrical portion which continues the pipe line but is machined inside so that its diameter may be accurately determined. In this portion a side hole is drilled through the wall or several holes lead into a piezometer ring, so that a connection may be made for measuring the static pressure of the fluid before it enters the constriction.

Following this preliminary straight part, the entrance cone of about 21 degrees total angle leads to the short cylindrical throat which is accurately machined and is provided with a side hole or holes for taking off the static pressure in the throat. The transition from the entrance cone into the straight throat is rounded off to an easy tangential curve, both to avoid the resistance caused by a sharp corner and to preclude the possibility that the fluid might break away from the wall at high speeds, and so not fill the throat completely. The diameter of the throat is usually between one-half and one-fourth of the entrance or pipeline diameter and there is usually a joint at the throat which facilitates inspection of the condition of the throat and sides holes and permits of accurate measurement of the throat diameter.

The end of the throat leads, by another easy curve, into the exit cone or diffuser which has a total angle of about five degrees to seven degrees. This terminates in the

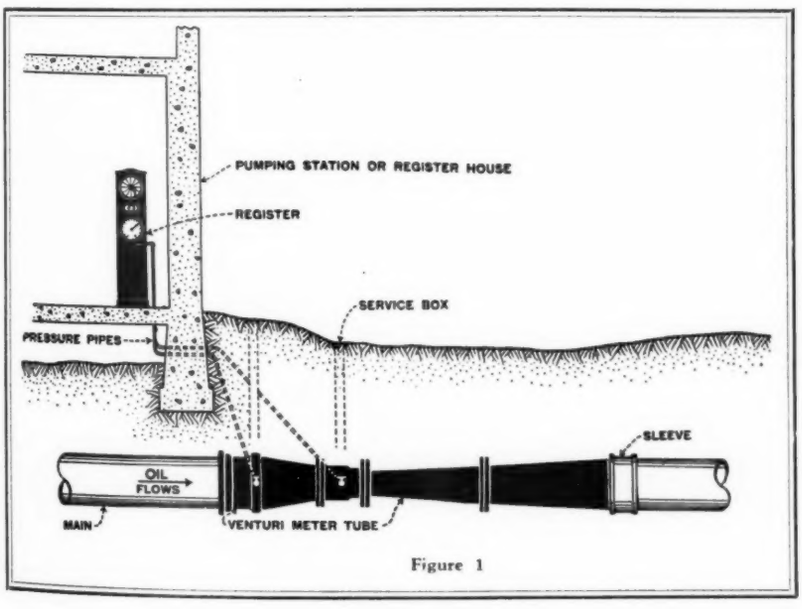


Figure 1

"The Nipple of Green Is the Nipple That's Seen"

Manufactured by
MID-CO PIPE *and* SUPPLY COMPANY, Inc.

Largest manufacturers of casing and line pipe nipples in the Mid-Continent.

Carrying complete stock for immediate shipment from 2-inch to 20-inch inclusive.

MID-CO PIPE *and* SUPPLY CO., Inc.

Offices and Plant:
5 North Guthrie Tulsa, Oklahoma

Oil Production Engineer

Large progressive industrial concern is interested in considering for employment an executive type Petroleum Engineer, graduate of accredited university, preferably having specialized in mathematics and physics. One who has progressed through the ranks from roustabout or similar capacity with general knowledge of connection work to supervise installation of separators, meters, etcetera, required for experimental work. Must have had experimental and original work in the field with either Bureau of Mines or some leading oil company and be qualified to undertake research work and make full report on his investigations. Also be thoroughly conversant with solubility of gases and multiple stage trapping. Man should be single and about thirty years of age. An outstanding opportunity for the right man. Address Russell N. Keppel, 26 Broadway, New York City, giving full qualifications, both technical and personal, also stating approximate salary required. Communications held confidential.

downstream flange for connecting the venturi to the following pipe line. A pressure connection is sometimes provided at the downstream flange for the purpose of determining the overall loss of head caused by the resistance of the venturi as a whole.

The Theoretical Venturi-Meter Equation for Liquids

$$Vt. = A \frac{1}{\sqrt{R^4 - 1}} \sqrt{2gh}$$

When Vt. = Theoretical rate of discharge cubic feet per
section A = Area of entrance section at the up-stream pressure connection, square feet.

R = ratio of entrance to throat diameter, D_1/D_2

g = acceleration of gravity = 32.174 at sea level and about 45 degrees latitude.

h = difference of level (feet) at which the liquid stands in two vertical tubes which are connected to the side holes at entrance and throat, respectively, and are either open at the top or connected through a closed air space.

The factor $\frac{1}{\sqrt{R^4 - 1}}$ depends only on the diameter ratio and is independent of the absolute size of the venturi. It expresses the effect of the amount of constriction of the stream. The factor A is independent of the design of the venturi and is fixed only by its absolute size. Its presence in the equation expresses the obvious fact that, other things being equal, the volume flow is proportional to the available area A. These two factors may be combined into a single meter constant.

$$M = \frac{A}{\sqrt{R^4 - 1}}$$

the value of which may be computed, once for all, from the measured diameters of the entrance and throat sections; and the theoretical equation may then be written in the form

$$Vt. = M \sqrt{2gh}$$

The Practical Venturi-Meter Equation for Liquids

For various reasons the rate of flow actually observed is usually slightly different from the theoretical value, and the practical equation is

$$V = CH \sqrt{2gh}$$

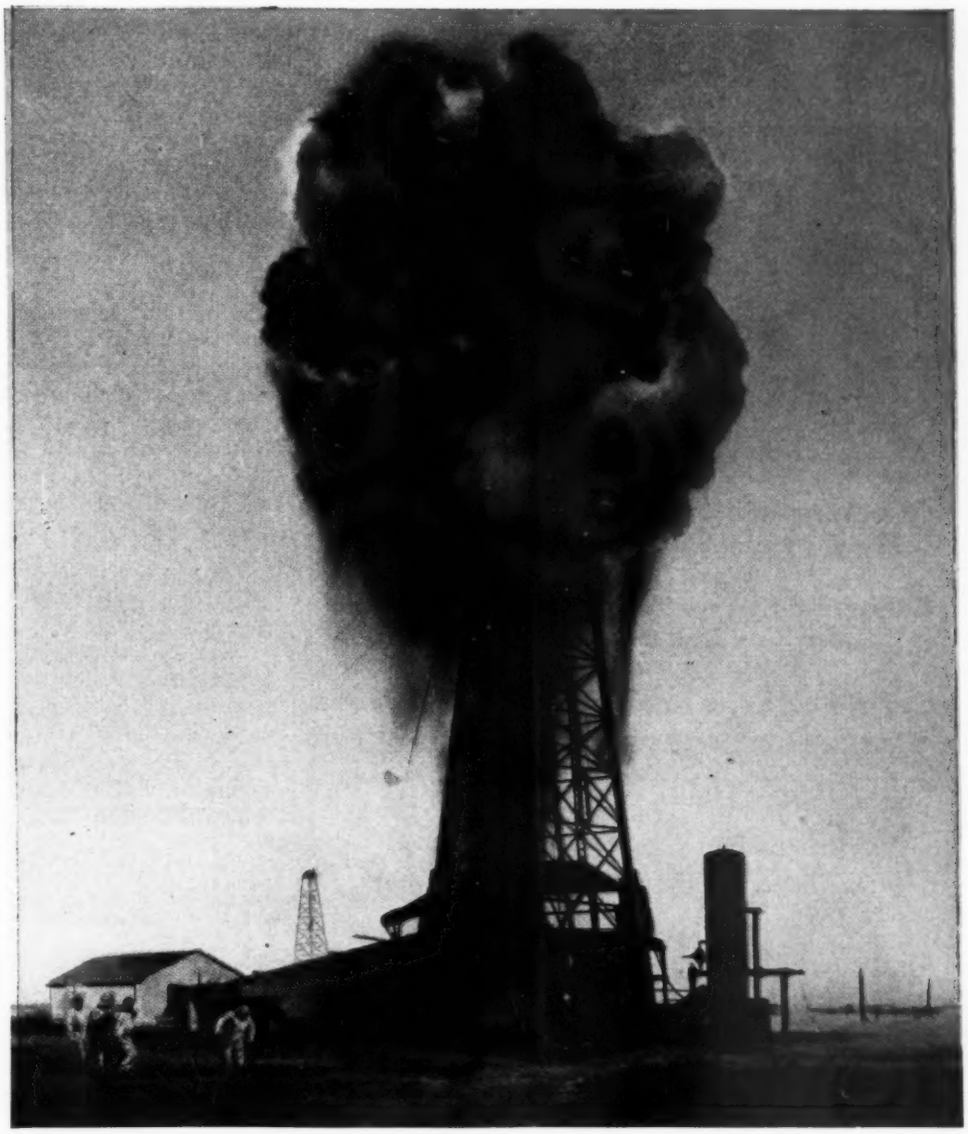
in which C is the "discharge coefficient."

For a frictionless venturi tube working under the ideal conditions presupposed by the theory, the discharge coefficient would be C = 1.00 exactly. Frictional resistance between the entrance and throat sections tends to reduce the value of C and abnormal conditions of installation or operation may make C either considerably greater or considerably less than unity. But in practice, if the venturi meter is well made and properly installed, and is of suitable size and diameter ratio for the rates of flow to be measured, the discharge coefficient is between 0.97 and 1.00. Under these normal condition C = 0.985 will give results accurate to within 2 per cent.

In ordinary practice the discharge coefficient is low at low rates of discharge and increases toward C = 1.00 as the rate of flow rises. If the coefficient is 0.96 or over, its further changes are slow and regular. Hence, it is a safe working rule to say that a venturi should always, if possible, be run at rates which make its coefficient at least 0.96; and that if it is to be used to measure lower rates, it should

Yours for the Asking!

» » This Remarkable Photograph in Color—Greatly Enlarged, 13x16½ inches—Ready for Framing



TAKEN by sheer luck, the photograph which appeared on the May front cover of The Petroleum Engineer is the industry's most unusual well-fire scene. The Skelly-Amerada University No. 1-A in Ector County, Texas, was being shot and a photographer, anticipating a gusher, had his camera trained on the derrick. Rocks thrown from the well came in contact with the steel crown block, creating a spark which ignited the flow of oil and gas. The flame had swept downward only half the length of the derrick when the picture was snapped.

There is not one chance in ten thousand that another such view, dependent upon hair-trigger action and exactly the right conditions, will ever again be taken. For this reason, The Petroleum Engineer will have made a number of beautiful reproductions in natural color, enlarged to 13x16½ inches, suitable for framing. These reproductions will contain no advertising matter whatever and will make a valued wall adornment for the office or home.

An enlargement will be sent without cost to each reader of The Petroleum Engineer who will fill out and mail the coupon at the right. As the number made available will be governed by the response to this advertisement within a limited time, promptness in sending the coupon will prevent us from running short.

THE PETROLEUM ENGINEER
Box 1970 Tulsa, Okla.

THE PETROLEUM ENGINEER PUB. CO.
Box 1970,, Tulsa, Okla.

Gentlemen: Please send me the enlarged reproduction of the picture which appeared on the May front cover of The Petroleum Engineer. It is understood that this is to be sent me without cost or obligation.

Signed_____

Address_____

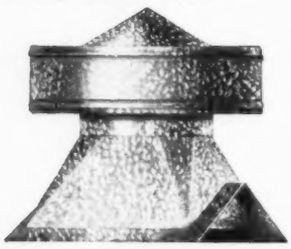
Company_____

Position_____

Southern Cornice Works

EVERYTHING IN SHEET METAL

118-120 SO. CINCINNATI AVE.
TULSA, OKLAHOMA



Revolving and Stationary Roof Ventilators
Metal Adjustable Flues for Lease Houses
Water Well Tubing
Galvanized Storage Tanks for Drinking Water
Galvanized Iron Spouting That Your Lease Foreman Can Erect

SHEET BRASS, SHEET ZINC AND COPPER

ACME DRILLING & FISHING TOOLS
SEAL OF QUALITY
DRILLING AND FISHING TOOLS
At Your Supply Store

Peak Quality ONLY

Acme Fishing Tool Co.
Parkersburg, W. Va.

Quasi-Arc

COVERED WELDING RODS

QUASI-ARC Electrodes are unequalled for boiler welding or other work subject to stresses at high temperatures and for joints requiring high resistance to shock and fatigue caused by alternating stresses. Write for technical folders describing the unique features of Quasi-Arc welding.

QUASI-ARC INCORPORATED
11 West 42nd St., New York
Representatives in 27 of the World's Largest Industrial Centers

For Better Welds

be tested in place and under working conditions to insure the reliability of its indications.

The coefficient is a numerical factor which can not be found from theory, and knowledge of its values necessarily rests on the various experimental determinations which have been made from time to time.

We will not undertake at this time to go into the subject of the variation of the coefficient with respect to the properties of the fluid. Let it suffice to say that for practical purposes it is not essential to determine such variation. The subject is discussed with respect to oil in a report of the special research committee on Fluid Meters by the American Society of Mechanical Engineers from which the writer has drawn liberally for the material here given.

Diagram of pipe line station layout designed to meter oil in transit while under pressure equal to head on tank. Oil flowing into the station on the suction side passes through the first meter (M1) and the volume passing through is recorded on the recorder located in the office. Any average not taken by the pumps will flow into the surge tank floating on the line through a relief valve. If more oil than is flowing through the main suction is handled by the pumps it is metered through Meter No. 2. The differences in volumes recorded by the two meters is rectified by the amount of oil in the surge tank.

The volume discharged by the pumps is metered through Meter No. 2 and recorded. Thus, if more or less oil is coming into the main line suction the difference will be indicated by comparing the two meter readings. The differences in volumes may be rectified by gauging the surge tank which should balance with the difference of the two meter readings. In this manner oil gathered at the station may be metered and put into the main line or main line shipments may be stored in tankage at the station and be metered while in transit.

Death of Isaac N. Hinderliter

Isaac N. Hinderliter, 84, of Oil City, Pa., died at his home on Tuesday, June 10, following a brief illness. Mr. Hinderliter was only seriously ill for about one week prior to his death, although he had been in poor health for a couple of years.

Born in Corsica, Pa., February 4, 1846, Mr. Hinderliter, at the age of 15, enlisted in the army as a drummer boy in Company G, 105th Pennsylvania Volunteers, known as the "Wildcat Regiment". He was one of the last members of the Rutherford B. Hays Post, Grand Army of the Republic.

After being mustered out of service in 1865, Mr. Hinderliter came to Oil City and entered the contracting business, hauling oil on Oil Creek. He later entered the mercantile and oil business with Charles Shepherd at Rouseville. There he married Clara Tyson, daughter of James Tyson, of Philadelphia.

In 1877 he purchased from George B. Foreman an oil lease near Oil City and remained in the oil business for about 30 years. He later moved again to Oil City where he served as Superintendent of Streets for several years, again entering the contracting business, which he conducted until retiring in 1918.

Surviving are two sons and two daughters: Frank J. Hinderliter of Tulsa, President of the Hinderliter Tool Co.; Charles A. Hinderliter, of Amarillo, Texas; Fannie and Daisy Hinderliter, Oil City, also three grandchildren, Donald, Betty and Jean Hinderliter, of Tulsa.

Petroleum Equipment

COMPANY OF TEXAS . . . INCORPORATED

Jon. R. Long, *Manager*

Your supply store can secure immediate shipment of Nu-Alloy Balls and Seats within two hours after your order is received.

FT. WORTH, TEXAS

Doomed
to become Obsolete!

?

The method of making periodical tests for specific gravity of gas by man by hand is fast becoming obsolete. With gravity varying throughout the day, how could any occasional test assure accuracy?

Do you estimate the speed of your car by counting the telephone poles you pass in a given length of time over a given strip of road—or do you not resort to a speedometer?

The Modern and Accurate Way

!

The GRAVITOMETER is a positive and accurate method of gauging and recording specific gravity of natural or artificial gas continuously.

Send for circular "P"—also Bulletin 14-P, concerning other of our scientific ACcurate MEasuring equipment.

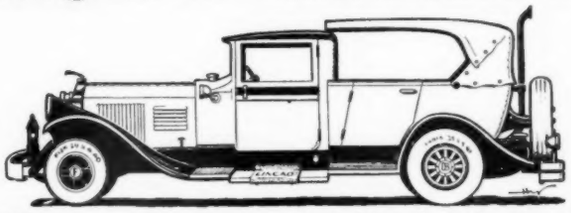
The Refinery Supply Company

621 E. 4th St. Tulsa, Okla.

3404 Main St.
Branch: Dallas, Texas

Pacific Coast Rep.
The Braun Corp.
363 New High St.
Los Angeles, Calif.

Speaking of Composite Installations



HERE is one . . . every single part hand picked, the apple of its maker's eye. Yes, it can be done, and with most striking effect.

A gasoline plant, likewise, CAN be built compositely—one type of absorber, another type of heat exchanger, another type of evaporator, and still another type of stabilizer. If variety is the aim, it may be had, and that abundantly.

But, if by chance, it is gasoline that is wanted, a GASOLINE PLANT had better be figured on, a UNIFIED plant.

The J. A. Campbell Company has for years specialized on unified plants. Each part of a unified plant is designed to perform a specific function, and bears as definite a relation to every other part as one organ of the human body bears to every other organ.

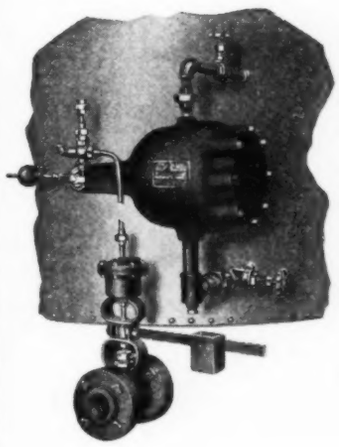
The Campbell organization has an uncontrollable hankering for making more and better gasoline, and maintains a corps of highly trained research men to that end.

Bulletin No. 7 explains the Campbell system. Write for your copy today.

J. A. CAMPBELL CO.
Natural Gas Engineers
CONSULTING DESIGNING CONSTRUCTING
PHONE-416-93
P.O. DRAWER 669
LONG BEACH, CAL.

STEARNS-ROGER MFG. CO., DENVER
MID-CONTINENT AGENCY

For Remote Control
of Liquid Levels in Refining



The rate of flow from Stills, Vaporizers, Bubble Towers and Dephlegmators must be controlled in order to maintain the necessary level of the contained condensates. The sure, safe and satisfactory system of exercising remote control is represented by the horizontal-float type VIGILANT Liquid Level Regulator. Details upon request.

The
Chaplin-Fulton Mfg. Co.
28-40 Penn Avenue
Pittsburgh, Pa.

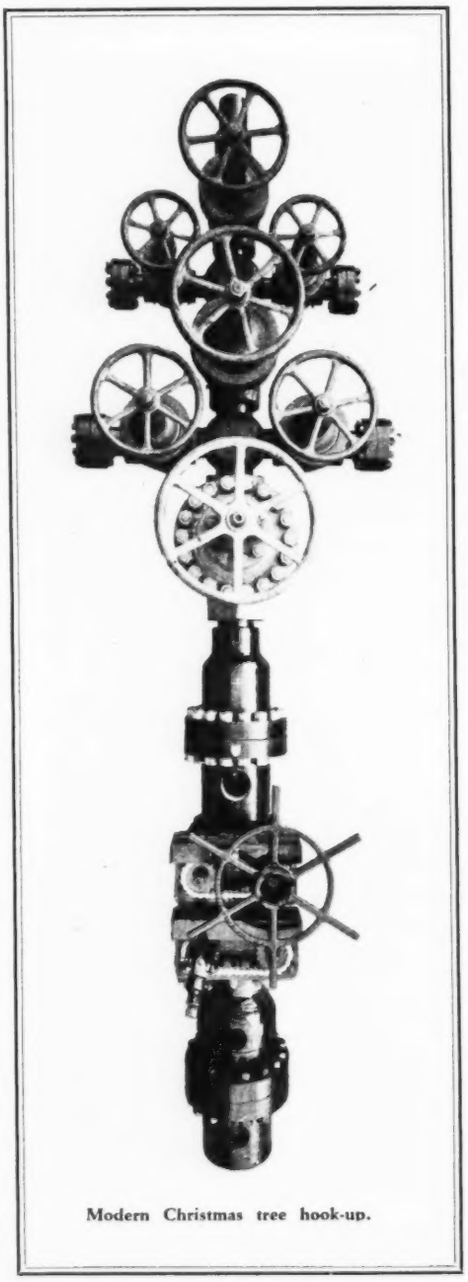
CF VIGILANT LIQUID LEVEL REGULATORS

Trends *in* Production Methods *for*

By R. H. PENCE, *Signal*

THE manner in which flush high pressure oil wells are placed on production, and the methods used for their control, have been subjected to a continual revisal. Practice that was considered good a short time past is now no longer followed. The new methods substituted will undoubtedly be revised, and the future will hold still more efficient ones. This transition cannot be considered a vogue, or a series of styles, but rather a search for an ultimate type of method which will produce a greater quantity of oil from the productive zone with less cost and less hazard, and in keeping with the economic need.

The old conception of producing a flush well was to pull it for all it was worth, thinking that if the oil was not obtained while the getting was good, it would be lost forever. Undoubtedly this conception was influenced largely by the type of operator who drilled the well. In many cases the operator drilled on a long shot, making the expenditure with great uncertainty. On the lucky completion of a good well he was interested in paying the bill and making as large a profit in as short a time as possible. Very little thought was given to the ultimate possibilities of the well's production, and untold thousands of barrels of oil have been sacrificed to this conquest of the nation's oil resources.



Modern Christmas tree hook-up.

Tubing Methods

The old practice of completing a well without tubing is rapidly disappearing. A tubed well may show a smaller initial production, but the decline will be decidedly lessened. Advocates of the untubed well are fast being converted, and many former staunch supporters are now favoring tubing. At the inception of this practice only a small proportion of tubing to the well's depth was installed, but gradually it has been lowered, until now, in most cases, it is set at least to the end of the oil string. Where liners are used, with perforations in keeping with the type of productive formation, in many cases we find the tubing is set with safety, well down in the liner. In other words, the trend now seems to be to lower the tubing as near the bottom of the hole as the hazard from bridges will permit.

The size of the tubing is also a factor of importance, and the majority of completions use a uniform size string, that is, the same size at top and bottom, but the trend is toward the graduated type of tubing, with the large size at the top, a medium size in the mid-section, and a small size at the bottom. The relative merits of these two types of tubing have received considerable discussion. The one size string allows the flow from the well to come through either the tubing or the annular space between the casing and tubing with equal facility, while the graduated string of tubing, of the type as mentioned above, is best adaptable for flow through the tubing. The trend seems to be toward the graduated tubing, as the small size at the bottom of the tubing permits the control, to a great degree, of the pressure at the bottom of the well, allowing a better use of the formational gas for lifting the oil to the surface.

Control of Formational Gas

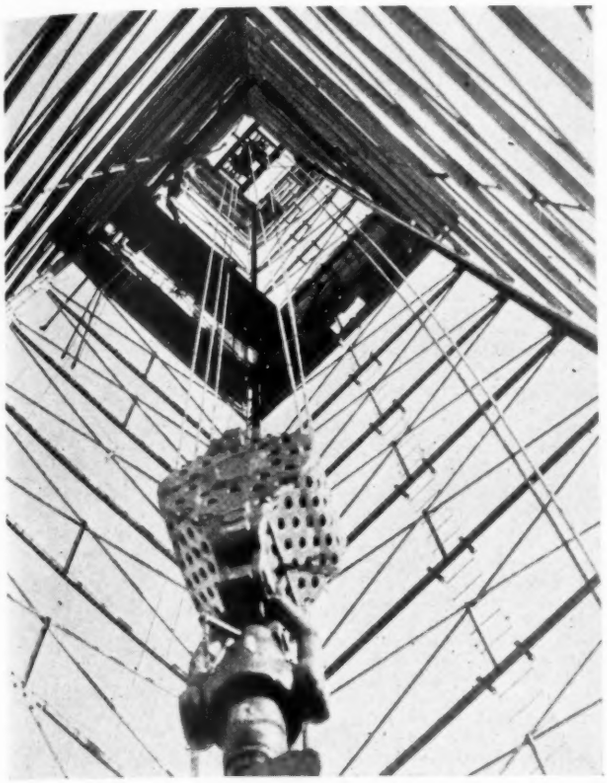
The method more generally practiced in the control of a well is by beaning, or restricting the flow from the well at the well's head. Several types of beans, or flow nipples, are in common use. The externally adjustable bean has gained great favor, owing to its facility of adjustment, and to its ready clearing of same from the outside. Tubing the well as mentioned aids materially, and the graduated string with the small bottom opening is of still further advantage.

Other methods have made their appearance with varying degrees of satisfaction. Bottom adjustable beans are of great worth when used within a tubing, and particularly with graduated tubing. In certain cases packers between tubing and casing near the top of the producing zone have proven advantageous, but they exclude the use of injected gas at a later period save when a ball check, opening into the tubing above the packer, is installed.

The early injection of gas into a well, to aid in lifting the production to the surface, has proved of value. High pressures are necessarily required, but it has been proven that this method offers large returns. A method of circulating oil early in the life of a well holds some merit, especially where an ungraduated string of tubing has been used. The additional oil increases the weight of the flowing column, occupies space formerly taken by high pressure gas, and acts in a manner as a bottom bean. Its low initial and operating costs are sometimes a factor in its use.

Handling High Pressure Wells

Engineering Co., Long Beach, Calif.



Looking straight up a modern rotary rig.

Economic Separation and Recovery of Gas

The practice of allowing the production to suffer a great drop in pressure through the well-head while on its way to the separators has been proven to be uneconomical. Great separator capacity is required at these low pressures, and all the gas is obtainable only at relatively low pressures. The trend is toward high pressure separation of the oil and gas, with secondary separation of the oil. This method makes possible the recovery of a great portion of the gas under high pressure. A bean or restriction is commonly placed as formerly at the well-head, but very much less drop in pressure is permitted across this restriction. It acts merely as a safeguard against the possibility of overloading the separator by a heading condition of the well.

The large amount of gas held in solution in the oil coming from the high pressure separator is adequately removed in the secondary separator, allowing no greater amount of tank vapors than formerly, and in many cases very much less. In fact, where a small third separator is used at pressures approaching atmosphere, the crude is stabilized.

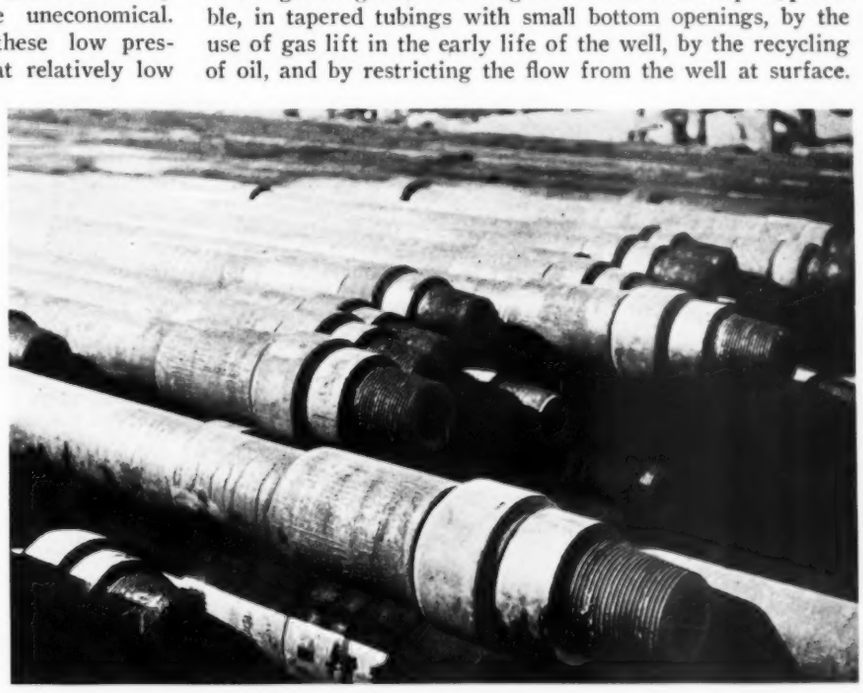
Recovery of Natural Gasoline

With the old practice of low pressure separation great quantities of gas were required to make a fair recovery of the natural gasoline, or lighter vapors from the oil, contained in the gas. This condition made necessary the installation of huge gasoline plants with great possibility of a small profit accruing from them because of their relatively short life. With the high pressure separation practically no commercial gasoline is contained in the high pressure gas separated from the oil. The pressure holds the heavier vapors in solution, and the act of separation is much like the bubble tower used in the absorption gasoline plant. When the oil is separated in the secondary separator these vapors make their escape from the oil, and a relatively small volume of gas containing a high content of gasoline then is available for treatment in the gasoline plant.

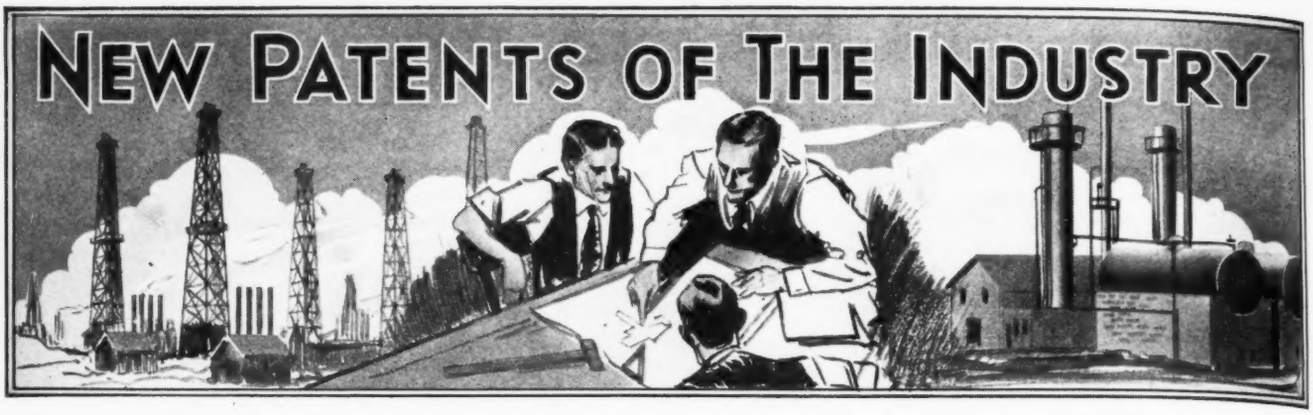
From the gasoline operator's point of view the trend will be toward this practice, as it permits him to operate with a greater profit. From the oil operator's standpoint the availability of high-pressure gas for any number of uses makes the trend in the same direction.

The use of the dry high pressure gas for the early recycling of gas in the flowing well makes the operator's investment in compressors relatively small, and where the gas is of sufficient pressure it can be used to great advantage in flowing older wells or wells of less pressure by means of gas lift. Its use for repressuring gas-depleted oil zones offers additional returns, as does also its storage in old gas formations for future use.

Trends of the present day may be summed up as being toward more orderly production in keeping with the economic need, and toward an end that will make possible the greatest ultimate recovery of oil. Methods employed in the production of oil lean toward the conservation of the formational gas occurring with the oil, and is exemplified in the growing use of tubing in wells set as deep as possible, in tapered tubings with small bottom openings, by the use of gas lift in the early life of the well, by the recycling of oil, and by restricting the flow from the well at surface.



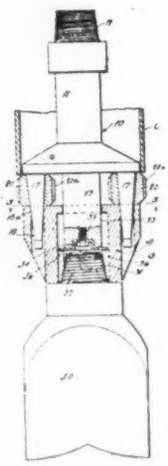
String of drill pipe equipped with protectors.



1,755,134. SUCKER-ROD ELEVATOR. GREGORY E. SAWYER, Independence, Kan. Filed March 15, 1928. Serial No. 261,917. 10 Claims. (Cl. 294—91.)

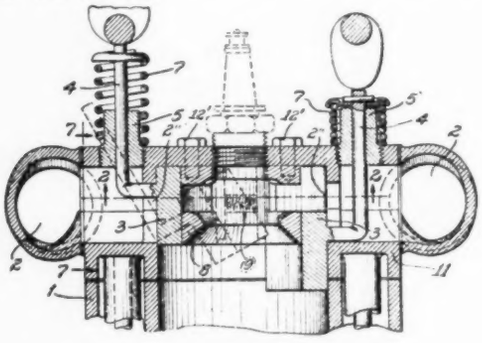
1. A sucker rod elevator comprising a body portion having a recess to receive the sucker rod, latch elements carried by the body portion and adapted to be projected into the recess, supporting actuating members pivoted upon the body portion and having cam faces to engage with the latch elements to project them, a support connected with the supporting actuating members, and means to lock the supporting actuating members to the body portion against turning movement, said means including spring pressed bolts carried by the actuating members.

1,754,530. EXPANDING REAMER. JAMES J. SANTIAGO, Los Angeles, Calif, assignor to John Grant, Los Angeles, Calif. Filed Dec. 24, 1928. Serial No. 328,125. 13 Claims. (Cl. 255—75.)



1. In an expanding reamer, a central vertically extending body with an enlarged head above its lower end, a plurality of vertically extending mandrels dependingly supported from the body head and spaced around the body below the head, cutter elements around the mandrels, and a follower surrounding and movable vertically on the body below the cutter elements.

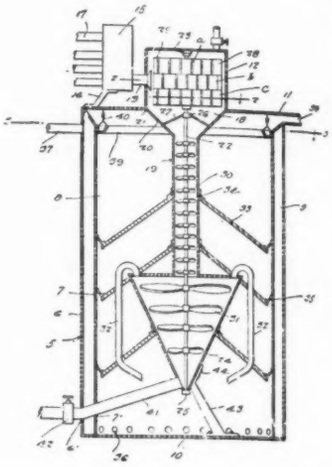
1,753,515. VALVE AND HEAD FOR GAS ENGINES. ALBERT C. HOECKER, St. Louis, Mo. Filed Dec. 1, 1926. Serial No. 151,936. 5 Claims. (Cl. 123—75.)

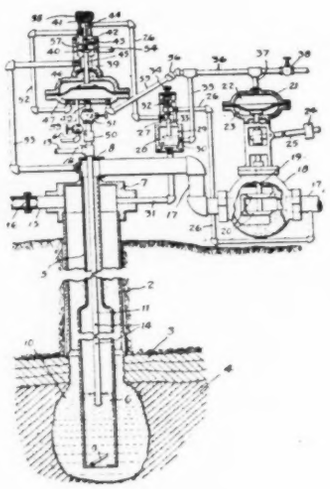


1. In a gas engine comprising a cylinder with a cylindrical head provided with inlet and exhaust ports, a cylindrical, segmental valve for each of said ports, said valves having a stem permanently attached thereto and said valves being of less circumference than the circumference of the inside of the cylinder, so that while the stem and valve may be in one piece the stem may be inserted into operative position through the ports and through the head substantially as described.

1,753,403. OIL SEPARATOR. JOSEPH W. CUSHMAN, JOHN D. EVERETT and CLINTON J. FARRELL, Vernon, Texas, assignors to John F. Merrick and W. A. Teague, Wichita County, Texas, R. E. L. Saner, said Farrell, and said Everett. Filed March 30, 1929. Serial No. 351,398. 7 Claims. (Cl. 210—61.)

1. In a device of the class described, a cylindrical tank comprising a pair of spaced walls dividing the same into an inner and outer chamber, a receiving head formed on the top of the tank and provided with an opening, an intake funnel formed centrally of and depending from the top of the cylinder into said inner chamber and communicating with the opening in the receiving head, a trap formed on the lower end of said funnel, a shaft journaled in the funnel and extending into the head and trap, cutting blades on the shaft and located within the funnel and trap, a power wheel on the upper end of the shaft and adapted to rotate within said receiving head.

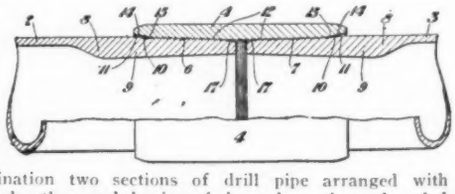




1,754,946. WELL-FLOWING APPARATUS. RICHARD M. HASKELL, Bradford, Pa., assignor of three-fourths to Tide Water Oil Company, Bayonne, N. J., a corporation of New Jersey. Filed Feb. 20, 1928. Serial No. 255,621. 20 Claims. (Cl. 103—11.)

1. Well-flowing apparatus comprising a well casing, means to supply motive fluid to the well to discharge liquid therefrom, fluid pressure means adapted to shut off the supply of motive fluid, including a fluid pressure conduit and a valve for controlling flow through said conduit, means to move said valve in response to a state of discharge of the well and to retain the valve in such moved position, and means to release the retaining means in response to change of pressure in the well casing.

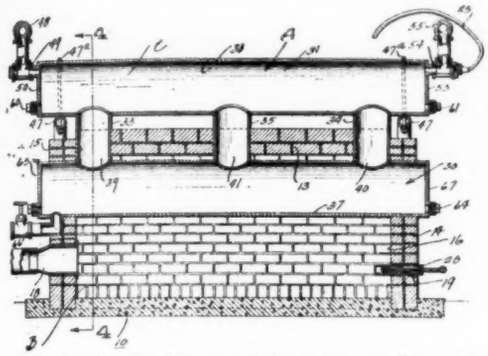
1,761,709. DRILL TUBE. THOMAS D. DAVIES, McKeesport, Pa., assignor to National Tube Company, a Corporation of New Jersey. Filed Dec. 21 1925. Serial No. 76867. 1 Claim. (Cl. 285—146.)



In combination two sections of drill pipe arranged with their ends opposite each other and having their end portions threaded on the exterior surface, and an internally threaded coupling member screwed onto

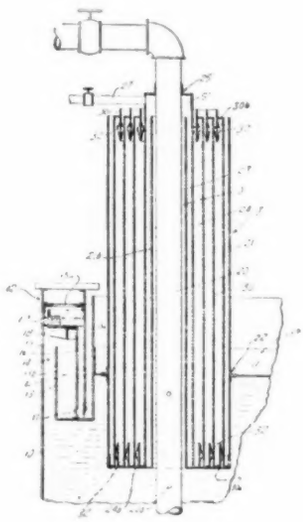
said abutting ends of said pipe sections to connect the same, said coupling being recessed at each end and provided with vanishing threads at the bottom of the recess portions, and said pipe sections having the ends of their threaded portions chamfered to the same angle as the angle of the vanishing threads at the bottom of the recess portions of said coupling, to assist in stabbing the joint and preventing injury to the starting threads.

1,754,079. APPARATUS FOR BREAKING UP PETROLEUM EMULSIONS. JOHN D. BRADY, El Dorado, Ark., a corporation of Delaware. Filed Dec. 18, 1925. Serial No. 76,339. 4 Claims. (Cl. 196—5.)



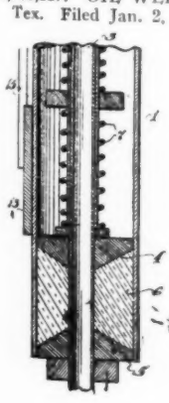
1. In a device for breaking up hydrocarbon emulsions the combination of upper and lower tanks, means to intercommunicate the tanks, means for heating the lower tank to a greater degree than the upper tank, means for feeding emulsified hydrocarbon into the upper tank, a single oil outlet in the upper tank for withdrawing oil in the liquid state, means for supplying fuel to the means for heating the lower tank, and means regulated by the temperature of the heated oil in the upper tank for automatically regulating the supply of fuel to said means for heating the lower tank.

1,754,597. OIL-TANK EXPANSION JOINT. CHARLES F. H. BOHNHARDT, Lynwood, Calif., assignor to Julian A. Campbell, Long Beach, Calif. Filed Dec. 5, 1928. Serial No. 324,041. 8 Claims. (Cl. 220—26.)



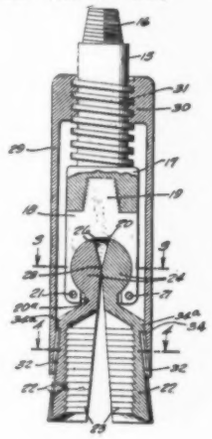
1. In a structure of the character described, a fluid container having a top closure, a vertical conduit communicating with the interior of the container and extending through said closure, the closure being spaced from said conduit and vertically movable relative thereto, and a vertically expansible joint between the conduit and said closure, said joint preventing fluid escape from the container between the conduit and top closure during their relative vertical movement.

1,761,227. OIL WELL HEATER. WOODSON C. PARSLEY, Wichita Falls, Tex. Filed Jan. 2, 1929. Serial No. 329,840. 1 Claim. (Cl. 219—33.)



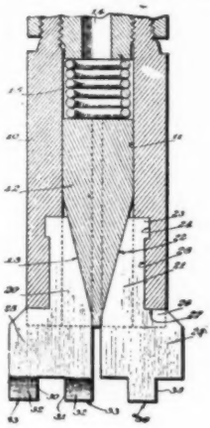
In combination with a string of tubing in an oil well, a casing disposed about said tubing and spaced therefrom and having its upper end closed, a heating unit within said casing, an expansion unit within said casing beneath said heating unit, said expansion unit comprising a pair of spaced conically shaped collars engaging the circumferential wall of the tubing and casing, and heat insulating means disposed between said collars and engaging the circumferential wall of the tubing and casing and filling the space between said walls and said collars.

1,761,463. FISHING TOOL. GOVENOR K. BECKETT, Bakersfield, Calif. Filed Oct. 10, 1928. Serial No. 311,644. 13 Claims. (Cl. 294—115.)



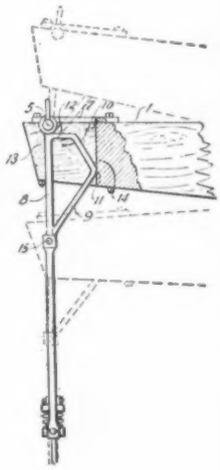
2. A fishing tool comprising a stem, a socket member on the stem, jaws having head members seated in the socket member to permit the jaws to occupy open and closed positions and to allow rotation of the stem independently of the jaws, a shoe threaded on the stem to occupy either of two extreme positions according as the stem is rotated in one direction or the other, said shoe housing the jaws when in one extreme position and exposing the latter when in the other extreme position, and a connection between the jaws and shoe for moving the jaws to open and closed positions according as the shoe is moved to one extreme position and then the other.

1,761,216. ROTARY DRILL. JOHN E. LE BUS, Electra, Tex., assignor, by mesne assignments to O'Donohoe Detachable Blade Drilling Bit Company, Wichita Falls, Tex., a Corporation. Filed Aug. 27, 1928. Serial No. 302,247. 1 Claim. (Cl. 255—61.)

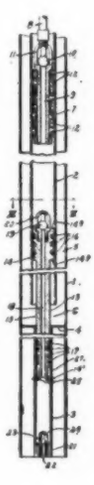


In a drill, a hollow body having axial sockets provided with lateral parts on its interior and each spaced inwardly from the periphery of the body so as to completely close the outer parts of the sockets and said lateral parts thereof, said body also having its bottom edge formed with axial cut-outs in register with the sockets, blades in the sockets having keys received in the lateral parts of the sockets and having shouldered parts engaged in the cut-outs and with the end walls formed by the cut-outs, said blades having downwardly and inwardly tapered inner side edges, a mandrel in the body having a tapered part engaging the tapered edges of the blades, and means to hold the mandrel engaged with said blades.

1,761,658. BEAM HANGER. CLINT M. COPELAND, Marland, Okla. Filed July 13, 1927. Serial No. 205,386. 5 Claims. (Cl. 74—17.)



1. A beam hanger comprising a rod having means for attachment to a walking beam having a slot in its end, a rearwardly projecting elbow-shaped camming portion on the rod to bear against the base of the slot in the walking beam and means for attaching the rod to a polish rod.



1,761,081. PUMP FOR ELEVATING LIQUID. WILLIAM F. LESCHEN, St. Louis, Mo. Filed Feb. 24, 1925. Serial No. 11,144. 2 Claims. (Cl. 103—46.)

1. A pump for raising fluids from great depths, comprising an outer casing adapted to extend from the level of the liquid upwardly to a point substantially adjacent to the outlet of the well, an inner casing arranged in concentric relation with respect to the outer casing having its lower end terminating above the extremity of the outer casing, and a plurality of independently arranged plungers located within the inner casing, said plungers being so constructed and arranged that movement imparted to one of the plungers to draw upwardly liquid located above the plunger will result in upward movement being imparted to the lower plunger by means of liquid in the outer casing working on the under face of the lower plunger.

INDEX *to* ADVERTISERS

A

	Page
Acme Fishing Tool Co.	188
Ajax Iron Works	79
Allis, Louis Co., The	
American Meter Company	132
American Roller Bearing Co.	18
American Tank Co.	57
Andrews Steel Co.	
Atmore, Robt. N., Co.	81
Axelson Manufacturing Co., Ltd.	179

B

Baash-Ross Tool Co.	7
Baker Oil Tools, Inc.	1
Barnickel, Wm. S., & Co.	58
Beaumont Iron Works Co.	
Blackor Co.	171
Black, Sivalls & Bryson, Inc.	97-98
Braun, C. F., & Co.	43
Brewster Co., Inc.	55
Broderick & Bascom Rope Co.	177
Brown Instrument Co.	
Buckeye Traction-Ditcher Co.	
Byron Jackson Co.	163

C

Cameron Iron Works, Inc.	
Campbell, J. A., Co.	189
Charlotte Chemical Laboratories, Inc.	177
Chaplin-Fulton Mfg. Co., The	189
Chicago Bridge & Iron Works	
Chicago Pneumatic Tool Co.	174
Christie Burner Co.	
Clark Bros. Co.	44
Colona Division Pittsburgh Screw & Bolt Corp.	53
Continental Supply Co., The	83
Cook, C. Lee, Mfg. Co.	184
Cooper-Bessemer Corp., The	138

D

Doheny Stone Drill Co.	48-49
Driftmeter, Inc.	
Dresser, S. R., Mfg. Co.	27

E

Electric Controller & Mfg. Co., The	183
Elliott Core Drilling Co.	134
Exchange Banks of Tulsa	85

F

Fisher Governor Co., The	141
Fluid Packed Pump Co.	81
Fluor Corporation, Ltd., The	3
Foster Wheeler Corp.	6
Foxboro Co., Inc., The	104
Franklin Valveless Engine Co.	86
Frick-Reid Supply Corp.	10

G

Gaso Pump & Burner Mfg. Co.	Inside Back Cover
General Electric Co.	
General Paint Corp.	
Gott, H. P., Mfg. Co.	184
Gray Processes Corp., The	8
Guiberson Corp., The	89

H

Halliburton Oil Well Cementing Co.	
Hanlon-Waters, Inc.	141
Hill, Hubbell & Co.	
Hinderliter Tool Co.	117
Hughes Tool Co.	Back Cover
Hyatt Roller Bearing Co.	121

I

International Derrick & Equip. Co.	62-63
International Petroleum Exposition	64
International Supply Co.	166

J

Jackson Engineering Corp.	
Jefferson Union Co.	131
Jensen Brothers Mfg. Co.	172
Jones, S. M., Co.	5

K

Kerotest Mfg. Co.	126
Key Boiler Equipment Co.	111
Kirk-Morrow Iron Works Co., The	137

L

Layne & Bowler Co.	180
Link-Belt Company	
Lucey Products Corp.	9
Lufkin Foundry & Machine Co.	31

Mc

	Page
McCord Radiator & Mfg. Co., Gasket Division	101
McCord Radiator & Mfg. Co., Lubricator Division	91
McEvoy, J. H., & Co.	173

M

MacPherson Construction Co.	15
Marley Co.	
Mason Regulator Company	
Merco Nordstrom Valve Co.	119
Metric Metal Works	132
Midco Pipe & Supply Co.	186
Midwest Piping & Supply Co., Inc.	
Miller Sand Pump Co.	
Miller, Max B., & Co., Inc.	Inside Front Cover
Moore, Lee C., & Co., Inc.	72
Moorlane Co., The	
Murray Tool & Supply Co.	66-67

N

National Equipment Corp.	69
National Supply Companies, The	71
National Tank Co.	124
National Transit Pump & Machine Co.	33
Naylor Pipe Co.	128
Norris Bros., Inc.	176

O

O. C. S. Manufacturing Co., The	92
Oil Conservation Engineering Co., The	
Oklahoma Contracting Co.	12
Oklahoma Gas & Electric Co.	76-77
Oklahoma Iron Works	166

P

Parkersburg Rig & Reel Co.	4
Patterson-Ballagh Corp	122-123
Penberthy Injector Co.	16
Petroleum Equipment Co.	189
Petroleum Rectifying Co.	51
Portable Rig Co., Inc.	
Prescott Company, The	168

Q

Quasi-Arc, Inc.	188

R

Ratigan, J. P.	181
Refinery Supply Co.	189
Regan Forge & Engineering Co.	38
Reid, Joseph, Gas Engine Co.	146
Republic Rubber Co.	109
Ridge Tool Co.	145
Robinson Orifice Fitting Co.	

S

Shaffer Tool Works	143
Sheldon Machinery Corp.	
Skinner Bros. Belting Co.	
Skinner, M. B., Co.	169
Smith, A. O., Corp.	2
Smith Engineering Co.	
Southern Cornice Works	188
Southwestern Engineering Corp.	
Spang, Chalfant & Co., Inc.	34-35
Spang & Co.	115
Spencer Trailer Co.	
Sperry-Sun Well Surveying Co.	11
Stoody Co.	46
Struthers Wells-Titusville Corp.	

T

Taubman Supply Corp.	14
Titusville Iron Works Co.	
Trimont Mfg. Co.	165
Tube-Turns, Inc.	74
Tulsa Boiler & Machinery Co.	

U

Union Wire Rope Corp.	60

V

Victaulic Co. of America	

W

Washington-Youree Hotel	184
Waukesha Motor Co.	
Westcott Valve Company	
Whealton & Townsend, Inc.	107
Wico Electric Co.	13
Wickwire Spencer Steel Co.	
Williams Bros., Inc.	113
Williams, J. H., & Co.	37
Winkler-Koch Engineering Co., The	94

Z

Zero Hour Torpedo Co.	40